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# REPORT

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TO THE

# CANADIAN PACIFIC RAILWAY

SANDFORD FLEMING, C.M.G.,

*ENGINEER-IN-CHIEF.*

1880.

OTTAWA:
PRINTED BY MACLEAN, ROGER & CO., WELLINGTON STREET.
1880.

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*To His Excellency the Right Honorable* Sir John Douglas Sutherland Campbell, *Marquis of Lorne, one of Her Majesty's Privy Council, Knight of the Most Ancient and Most Noble Order of the Thistle, and Knight Grand Cross of the Most Distinguished Order of Saint Michael and Saint George, Governor General of Canada, and Vice-Admiral of the same.*

May it Please Your Excellency:

The undersigned has the honor to present to Your Excellency the Report of the Engineer-in-Chief of the Canadian Pacific Railway, on the various surveys and examinations made during the past season, and on other matters in connection with that undertaking.

I have the honor to be Your Excellency's
Most obedient servant,

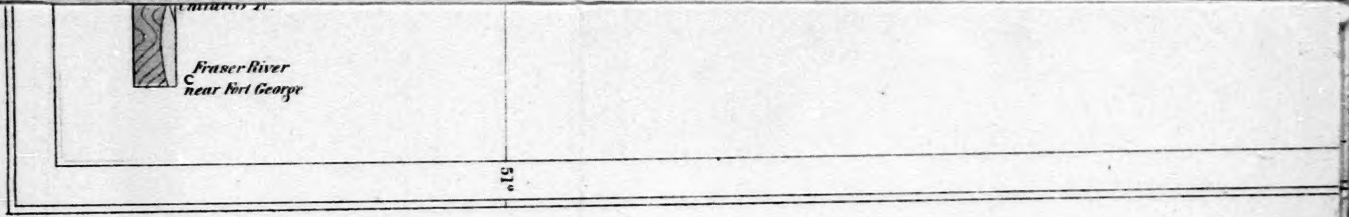
CHARLES TUPPER,
*Minister of Railways and Canals.*

CANADIAN PACIFIC RAILWAY,
OFFICE OF THE ENGINEER-IN-CHIEF.

To the Honorable
Sir CHARLES TUPPER, K.C.M.G., C.B.,
Minister of Railways and Canals.

SIR,—I have the honor to submit, for the information of His Excellency the Governor General in Council, the accompanying Report on the surveys made during the past season, also on the progress of construction, and on other matters in connection with the Canadian Pacific Railway.

I have the honor to be, Sir,
Your obedient servant,
SANDFORD FLEMING,
*Engineer-in-Chief.*


Fraser River
C
near Fort George
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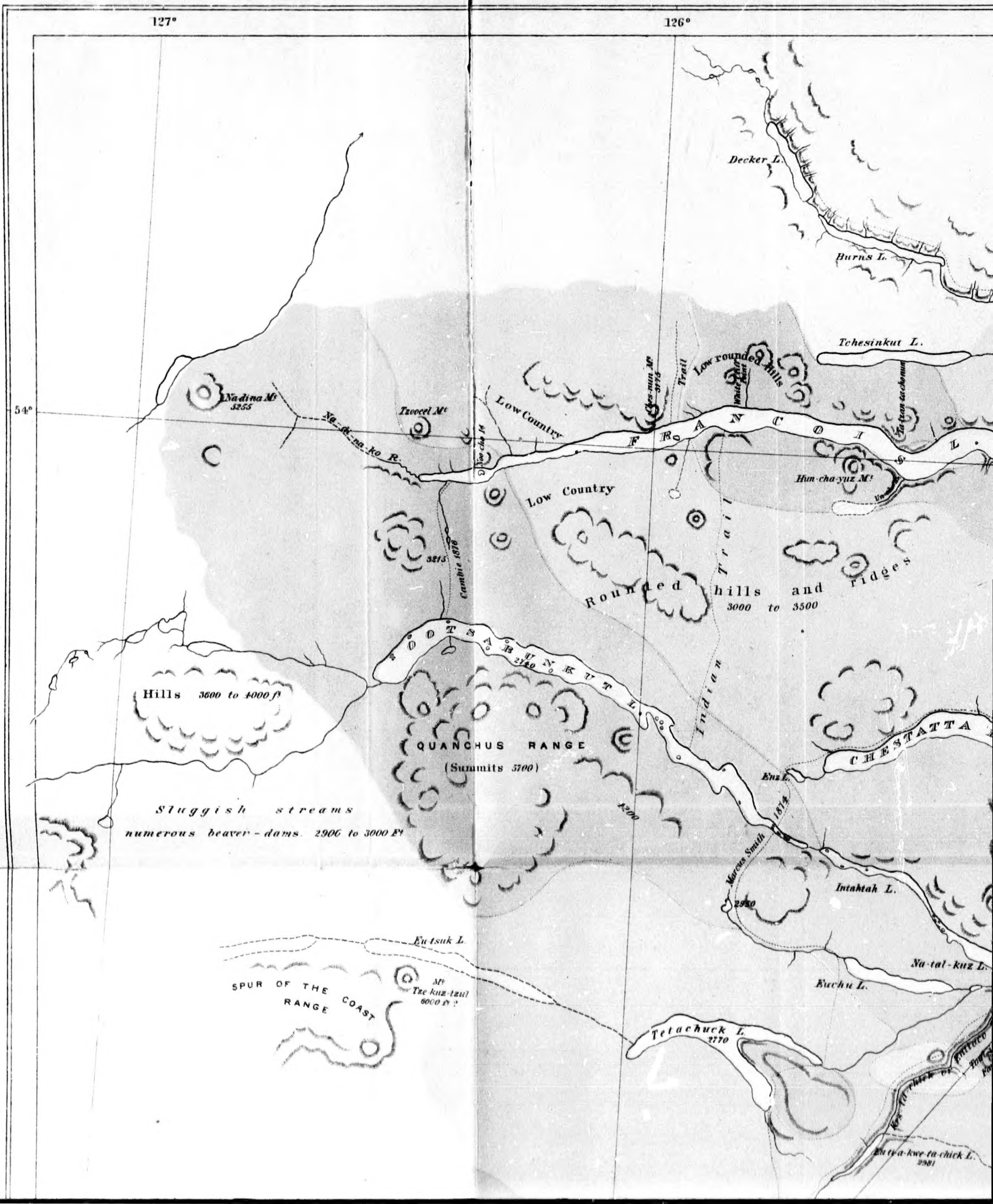
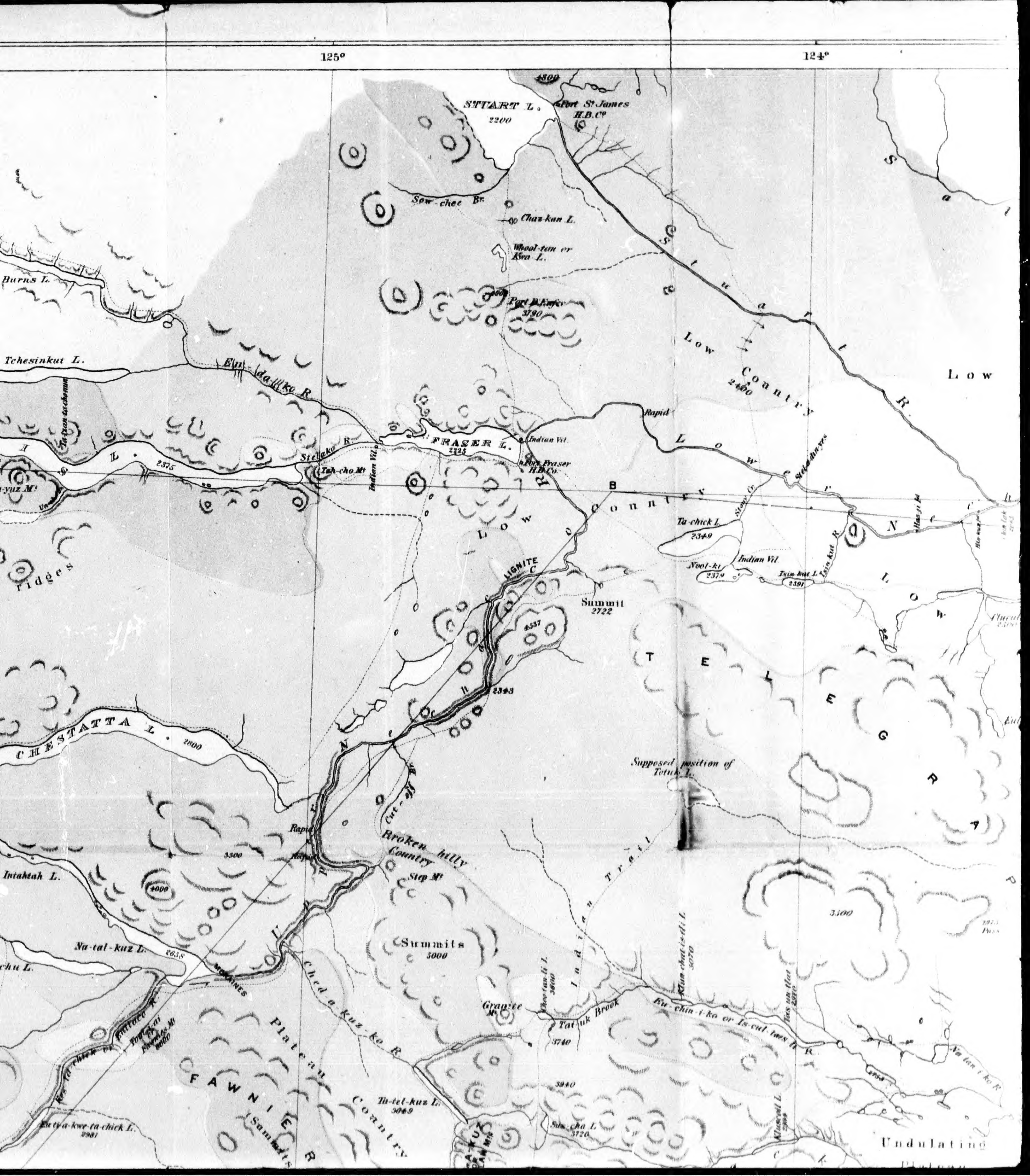
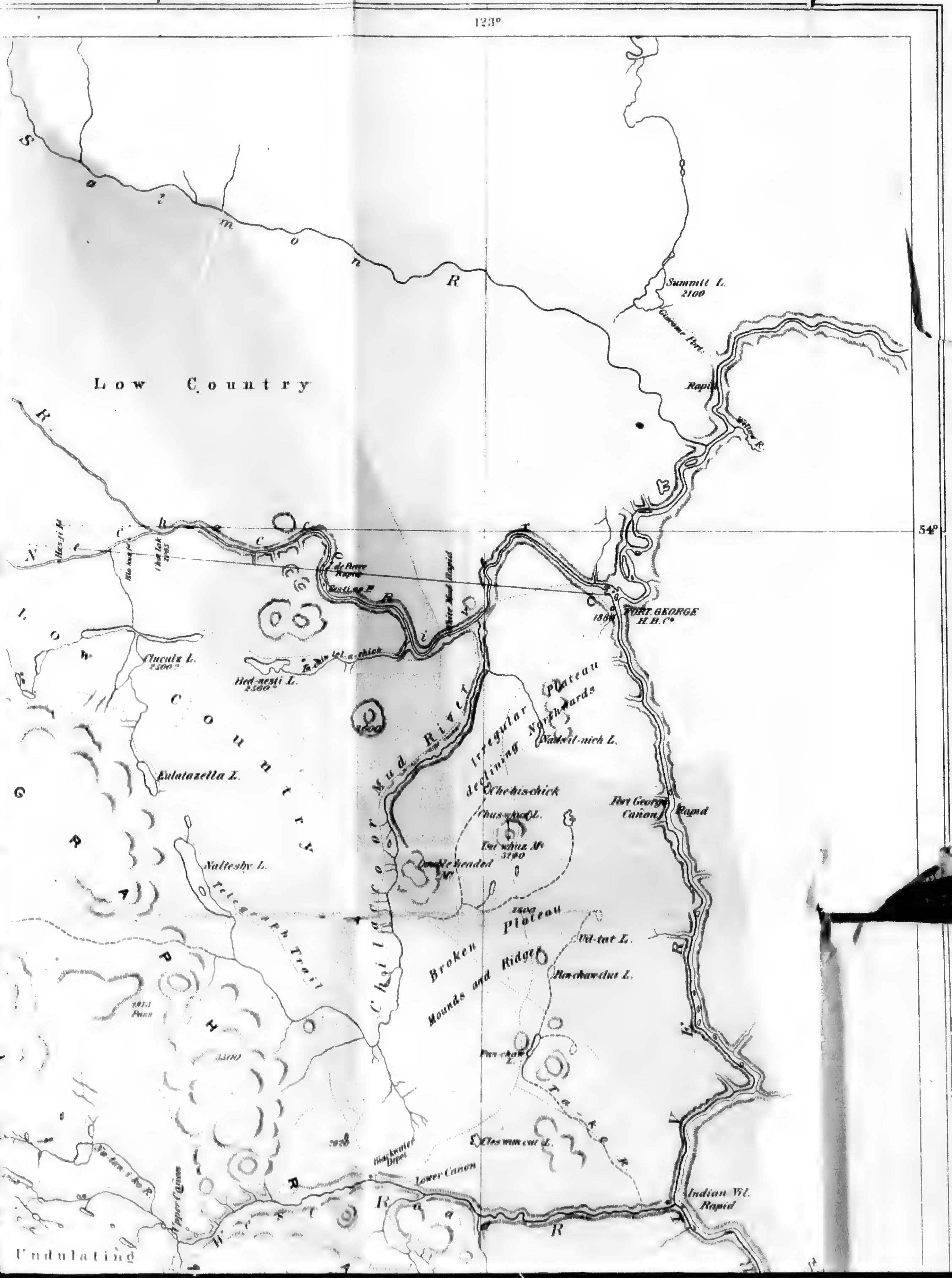
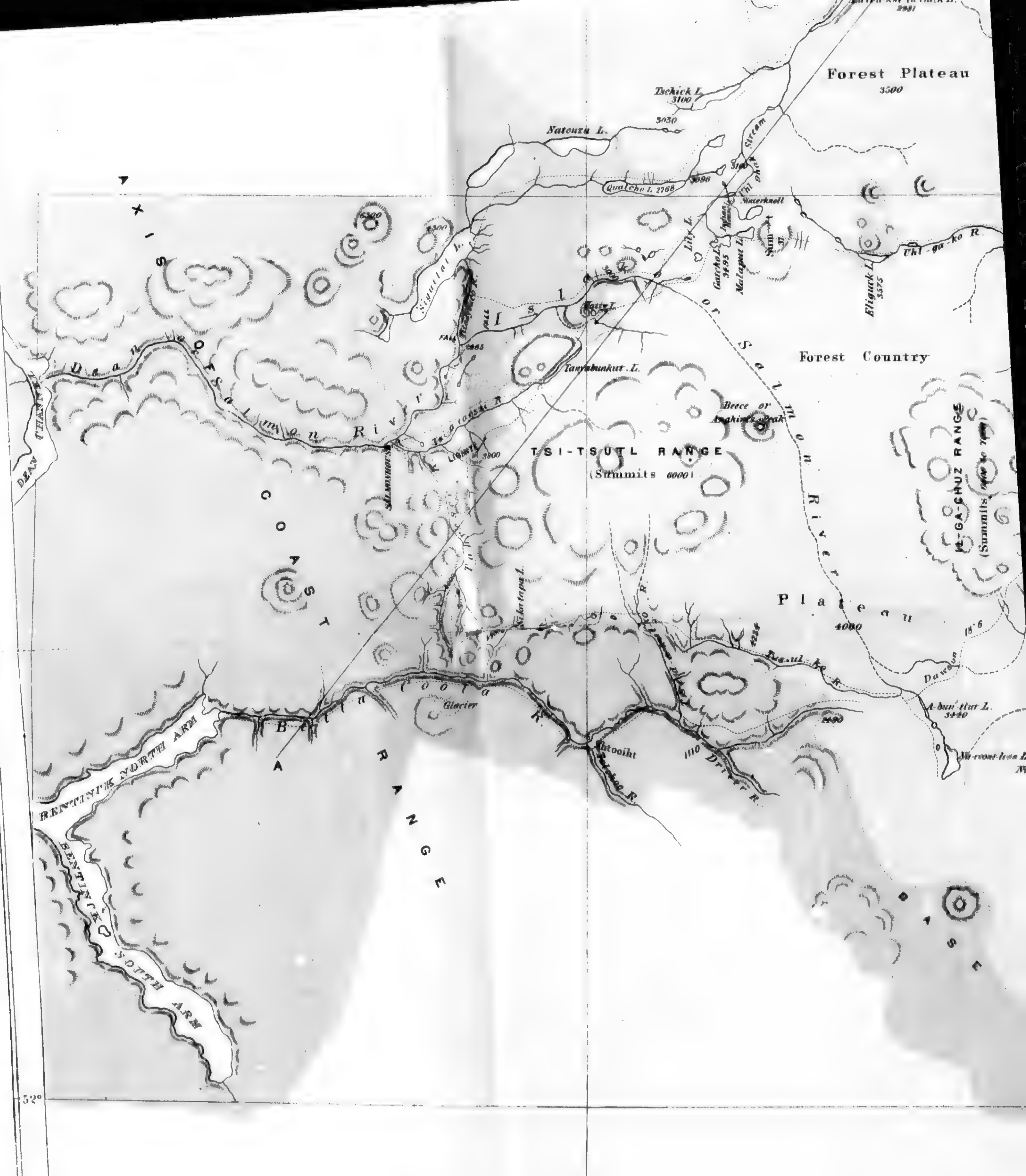
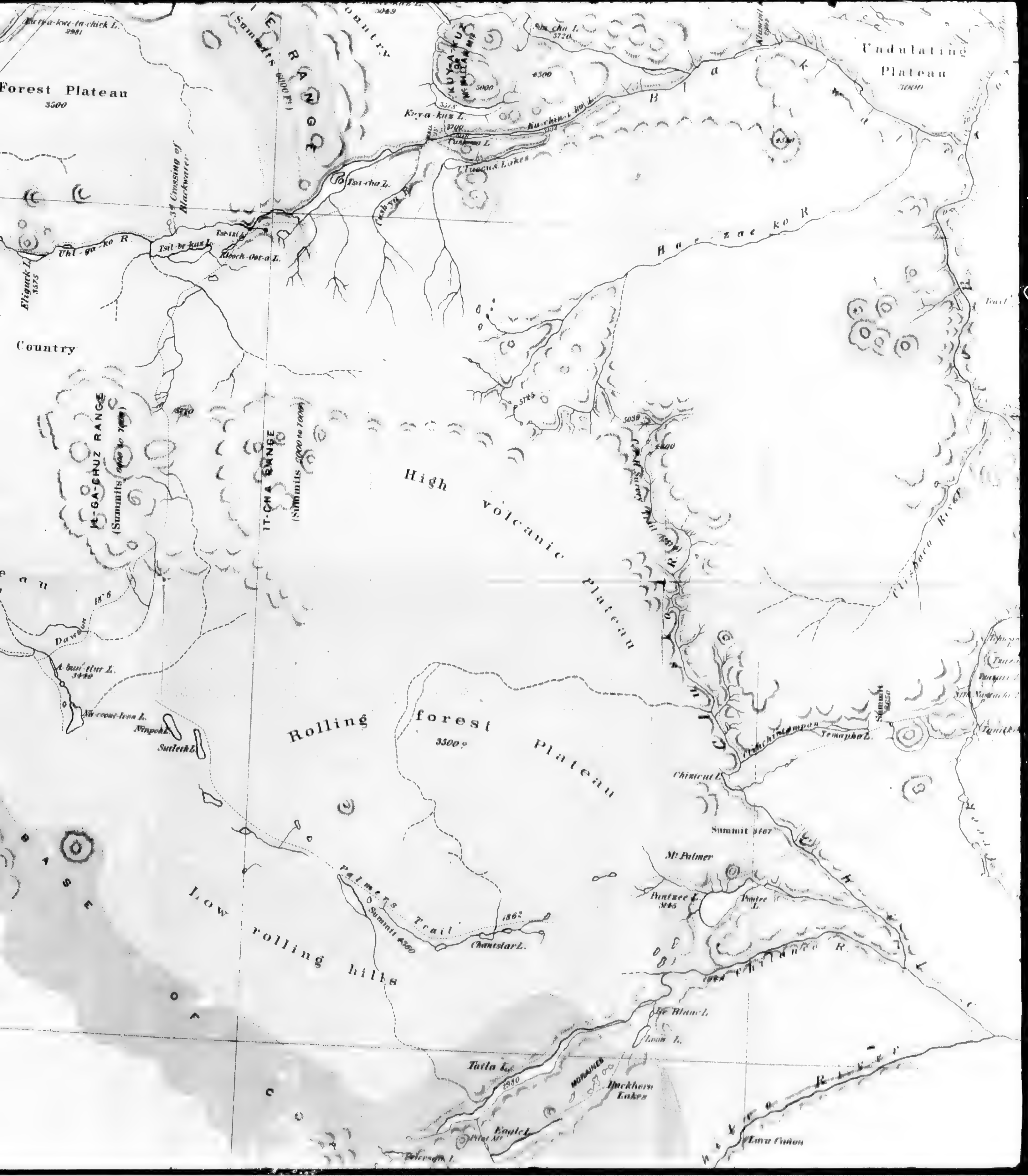
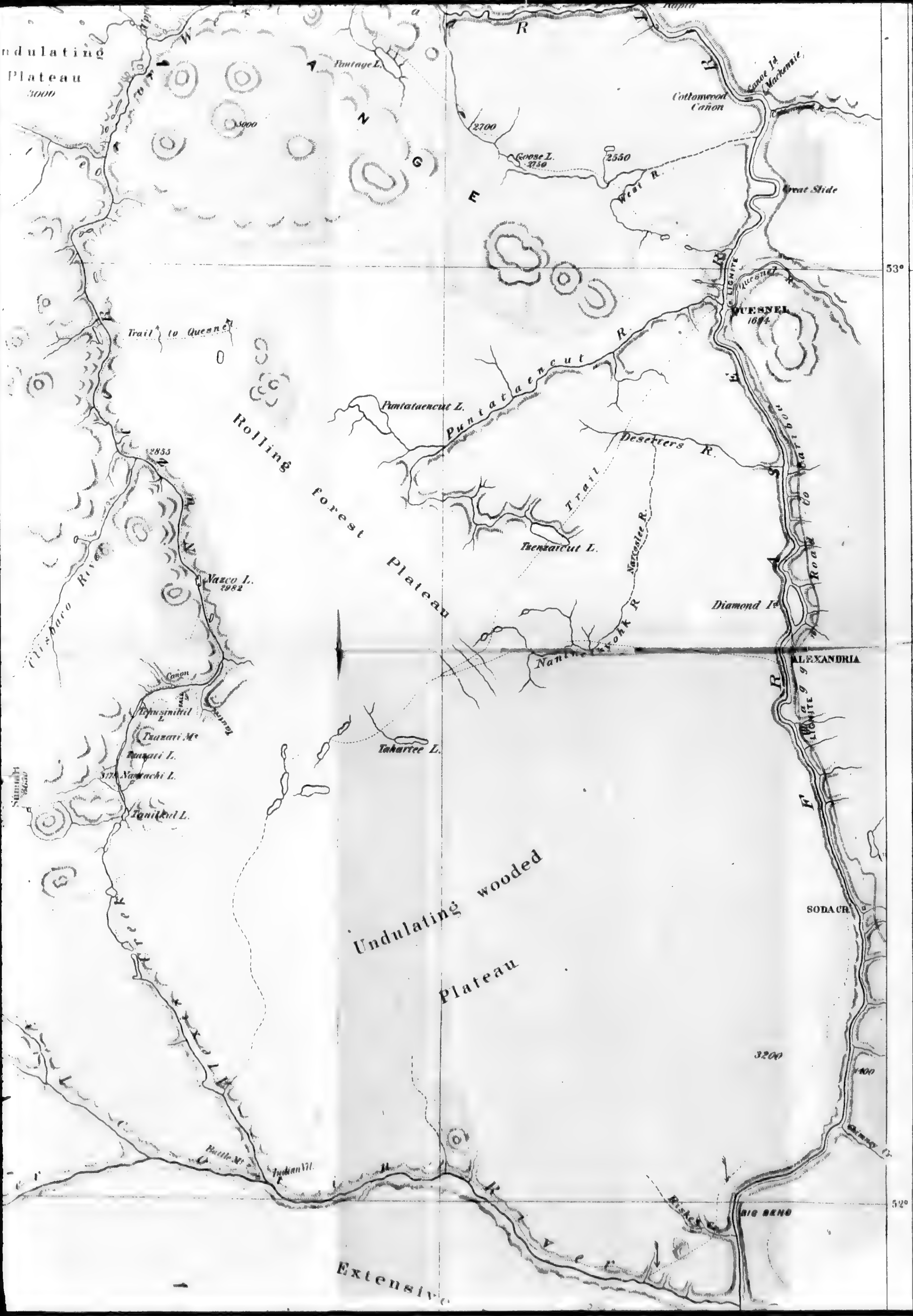

127°
126°
54°
Decker L.
Burns L.
Tchesinkut L.
Low rounded hills
Ches-nun Mt 3775
Trail
White Cliff Point
Ta-tzan-ta-chonun
Nadina Mt 3255
Tzoocel Mt
Na-dt-na-ko R.
Nov-cha-ta
Low Country
F R A N C O I S L.
Hun-cha-yuz Mt
Low Country
3215
Cambie 1876
Indian Trail
Rounded hills and ridges
3000 to 3500
N O O T S A - R U N K U T L.
2740
Hills 3600 to 4000 ft
QUANCHUS RANGE
(Summits 5700)
CHESTATTA
Enz L.
1814
Marcus Smith
Sluggish streams
numerous beaver-dams. 2906 to 3000 Ft
Intahtah L.
2950
Eutsuk L.
Mt Tze-kuz-tzul 6000 ft ?
SPUR OF THE COAST RANGE
Na-tal-kuz L.
Euchu L.
Tetachuck L.
2770
Kes-ta-chick or Entiaco
Eutsa-kwe-ta-chick L.
2981

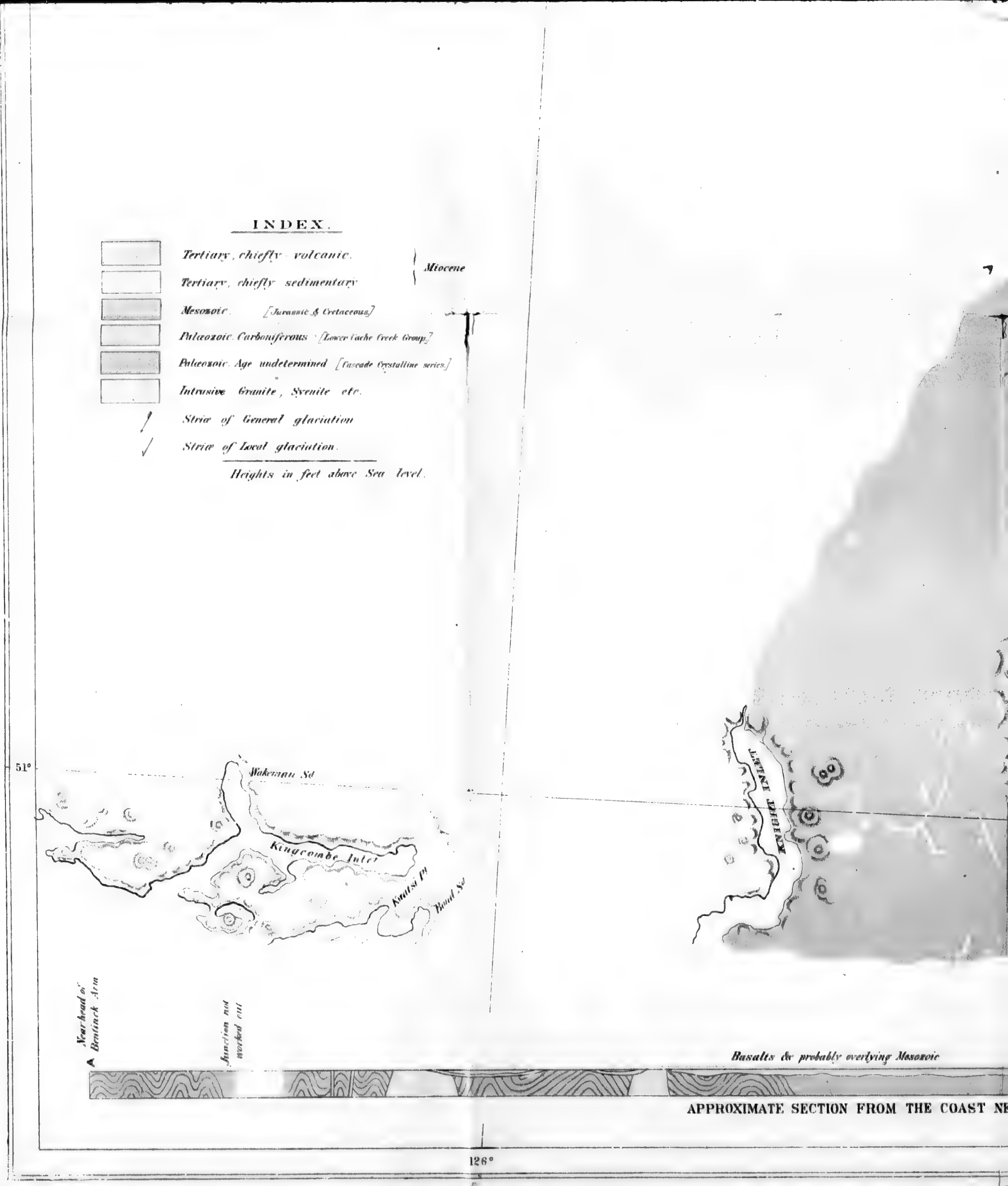

125°
124°
STUART L.
2200
Fort St James H.B.Co.
4800
Sow-chee Br.
Chaz-kan L.
Whool-tan or Kwa L.
Fort D Fraser 3790
Burns L.
Tchesinkut L.
En-da-ko R.
FRASER L.
2225
Indian Vil.
Fort Fraser H.B.Co.
Stellako R.
Tah-cho Mt
2375
Low Country
2400
Stuart R.
Low
Rapid
Lower Country
Ta-chick L.
2349
Nool-ki
2379
Indian Vil.
Tsin-kut L.
2391
Tsin-kut R.
ridges
LIGNITE
Summit
2722
4537
2343
CHESTATTA L.
2800
TELEGRAPH
Supposed position of Totuk L.
Cut-off Br.
Rapid
Broken hilly Country
Step Mt
3500
4000
Intahtah L.
Summits
3000
Indian Trail
Na-tal-kuz L.
2658
MORAINES
Plateau
Ched-a-kuz-ko R.
Granite Mt
Tat-uk Brook
3740
Eu-chin-i-ko or Is-cul-taes R.
Klun-chat-is-dli L.
3070
Na-tan-i-ko R.
3940
Ta-tel-kuz L.
3069
Sas-cha L.
3720
Country
FAWNIE R.
Summits
Ku-ya-kwe-ta-chick L.
2981
Undulating Plateau
Low
3500

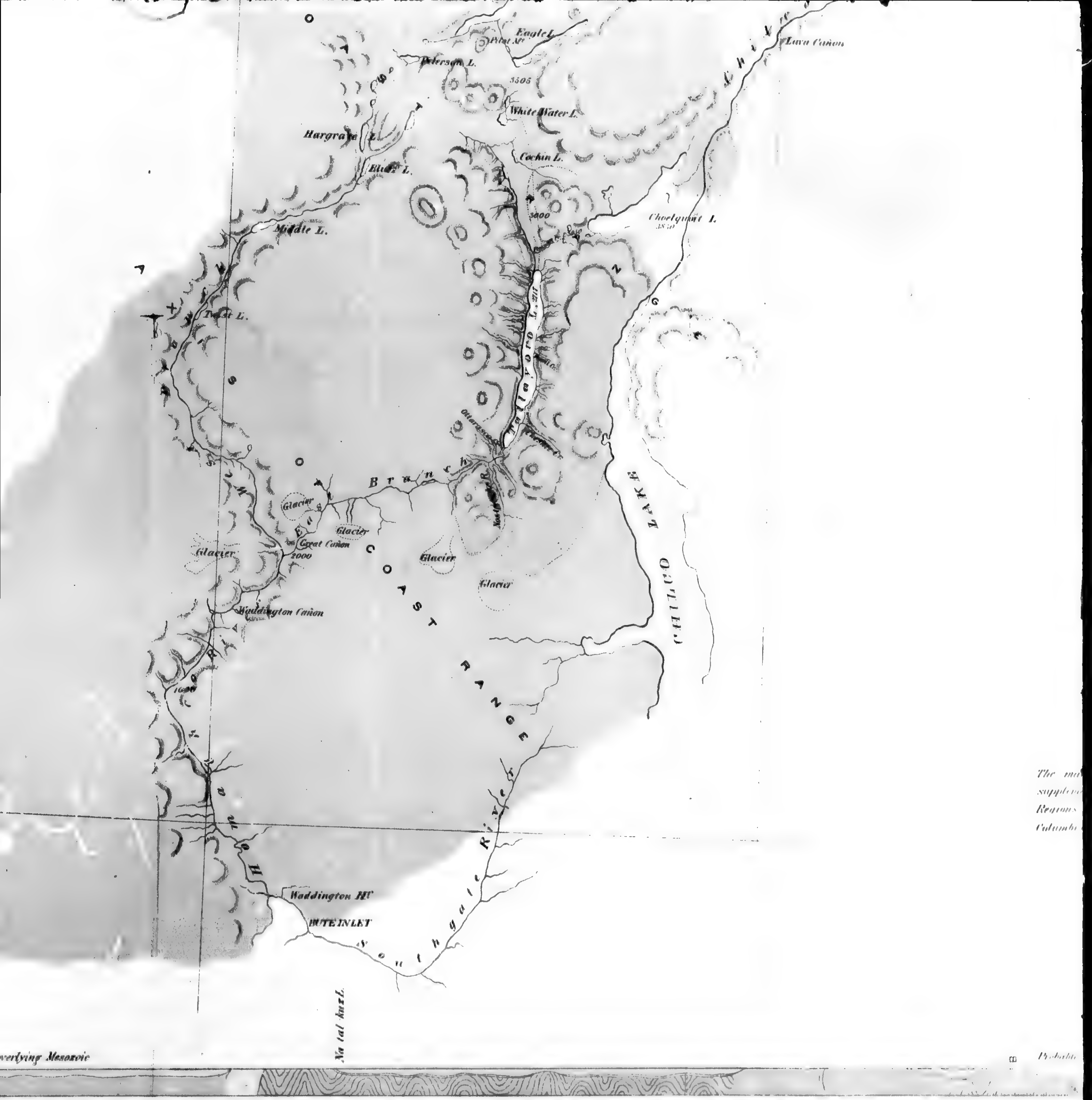

123°
54°
Salmon R
Summit L.
2100
Giscome Port.
Rapid
Willow R.
Low Country
Nechaco R
Hesji R
Blo kaz R
Chi lak
2705
L. de Pierre Rapid
Nesti-ne R
White Mud Rapid
Ta-bin-lel-a-chick
Cluculz L.
2500
Bed-nesti L.
2560
2600
FORT GEORGE
H.B.C°
1880
Low Country
Irregular Plateau declining Northwards
Nadsit-nich L.
Eulatazella L.
Chilako or Mud River
Chehischick
Chus-whuz L.
Tut-whuz Mt.
3200
Fort George Cañon
Rapid
Double headed Mt.
Naltesby L.
Telegraph Trail
GRAPH
2800
Broken Plateau
Mounds and Ridges
Uil-tat L.
Paw-chaw-tlut L.
2973
Pass
3500
Pun-chaw L.
Ta-ker-R.
3038
Blackwater Depot
Lower Cañon
Cles wun cut L.
Na-tan-l-ko R.
Upper Cañon
West R
R
Indian Vil. Rapid
Undulating


Forest Plateau
3500
Tschick L.
3100
3030
Natouzu L.
Qualcho L. 2768
3096
3100
Stream
Uhl ghak
Sinterknell
Lily L.
Gatcho L.
3495
Malaput L.
Eliguck L.
3575
Uhl-ga-ko R.
Sigutlat L.
6300
3300
Tanyabunkut L.
Forest Country
Beece or Anahim's Peak
Salmon River
TSI-TSUTL RANGE
(Summits 6000)
IL-GA-CHUZ RANGE
(Summits 7000)
Plateau
4000
Dawson
A-bun'tlut L.
3440
AXIS OF COAST RANGE
Dean or Salmon River
DEAN CHANNEL
Stuiamoos
Tsi-gladsai R.
LIGNITE
3800
Nikotapa L.
2254
Tsa-ul-ko R.
Bella Coola R.
Glacier
Nutsooiht
Noosgultch R.
1110
Driver R.
2490
BENTINCK NORTH ARM
BENTINCK SOUTH ARM
FALL
2965
53°
52°


Kut-ya-kwe-ta-chick L. 2981
Forest Plateau 3500
Country
Summits (6000 Ft.)
E RANGE
KUYA-KUZ
5000
4300
3575
Kuy-a-kuz L. 3700
Shu cha L. 3720
Undulating Plateau 3000
B l a c k
Ku-chun-i-ko L.
Tush L.
Cluscus Lakes
Tsa-cha L.
Cushya R.
3d Crossing of Blackwater
Uhl-ga-ko R.
Tsil-be-kuz L.
Tsi-tzi L.
Kloch-Oot-a L.
Eliguck L. 3575
Baezaeko R.
Country
IL-GA-CHUZ RANGE (Summits 6000 to 7000)
IT-CHA RANGE (Summits 6000 to 7000)
5710
5725
5039
4400
High volcanic Plateau
Clizbaco River
Trail
eau
1876
Dawson
A-bun-tlut L. 3440
Na-coont-loon L.
Ninpoh L.
Sutleth L.
Rolling forest Plateau 3500
Chinichintampan
Temapho L.
Summit 3650
Chizicut L.
Summit 3467
Mt Palmer
Puntzee L. 3845
Puntzee L.
Chilanco R.
Palmers Trail
Summit 4300
1862
Chantslar L.
Low rolling hills
BASE OF
Tatla L.
2950
MORAINES
Buckhorn Lakes
Eagle L.
Pilot Mt
Le Blanc L.
Loon L.
Lava Cañon
River
Nastache L.


Undulating Plateau
3000
W E S T
R A N G E
Pantage L.
3000
Rapid
Canoe Id
Mackenzie
Cottonwood Cañon
2700
Goose L.
2750
2550
West R.
Great Slide
53°
Quesnel R.
QUESNEL
1684
LIGNITE
Trail to Quesnel
Puntataencut L.
Puntataencut R.
Deserters R.
Trail
Tsenzaicut L.
Nazcoslee R.
Rolling forest Plateau
2855
Nazco L.
2982
Clisbaco River
Diamond Id
ALEXANDRIA
Nan
kyohk R.
Cariboo Road
LIGNITE
F R A S E R
Cañon
Tahartee L.
Tzusinitul L.
Tsuzati Mn
Tsuzati L.
Nazrachi L.
Summit 3650
Tanitkul L.
Undulating wooded Plateau
SODA CR.
3200
1400
Chimney Cr.
Battle Mn
Indian Vil.
C H I L C O T I N
R I V E R
Riske Cr.
BIG BEND
52°
Extensive


INDEX.
Tertiary, chiefly volcanic.
Tertiary, chiefly sedimentary
Miocene
Mesozoic. [Jurassic & Cretaceous]
Palæozoic. Carboniferous [Lower Cache Creek Group]
Palæozoic. Age undetermined [Cascade Crystalline series]
Intrusive Granite, Syenite etc.
Striæ of General glaciation
Striæ of Local glaciation.
Heights in feet above Sea level.
51°
Wakeman Sd
Kingcombe Inlet
Kwatsi Pt
Bond Sd
KNIGHT INLET
A Near head of Bentinck Arm
Junction not worked out
Basalts &c probably overlying Mesozoic
APPROXIMATE SECTION FROM THE COAST NE
126°

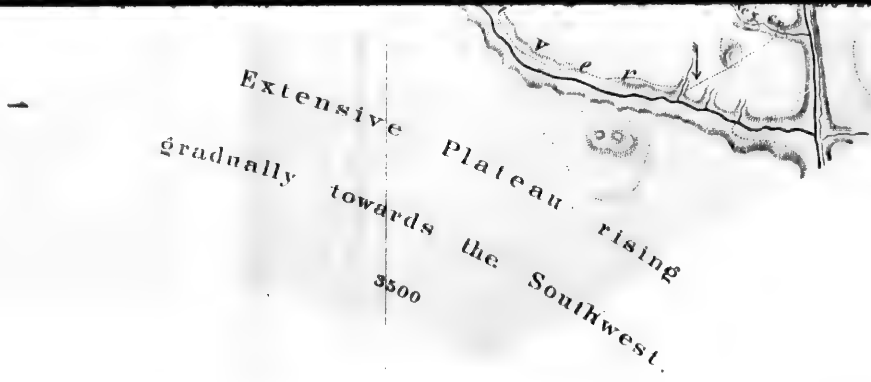


FROM THE COAST NEAR BENTINCK NORTH ARM TO THE VICINITY OF FORT FRASER AND THENCE TO THE FRASER RIVER NEAR FORT GEORGE

125°

124°

The Burland-Desbarats Litho. Co Montreal.



GEOLOGICAL SURVEY OF CANADA
*Alfred R. C. Selwyn, F.R.S., F.G.S. Director*

# GEOLOGICAL MAP
of
*a portion of*
# *BRITISH COLUMBIA*
*between the*
# *FRASER RIVER AND THE COAST RANGE*
by
George M. Dawson, Assoc. R.S.M., F.G.S.
1875-76.

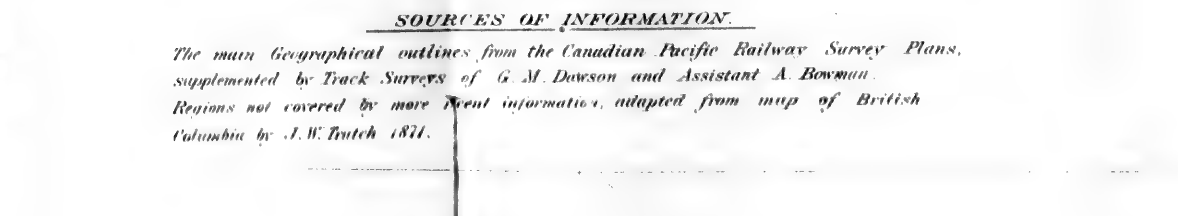
*Scale for Map and Section*

0 4 8 16 24 32 MILES

*Drawn by Bernard F. Wardell*

## *SOURCES OF INFORMATION.*

*The main Geographical outlines from the Canadian Pacific Railway Survey Plans, supplemented by Track Surveys of G. M. Dawson and Assistant A. Bowman. Regions not covered by more recent information, adapted from map of British Columbia by J. W. Trutch 1871.*



NEAR FORT GEORGE.

123°

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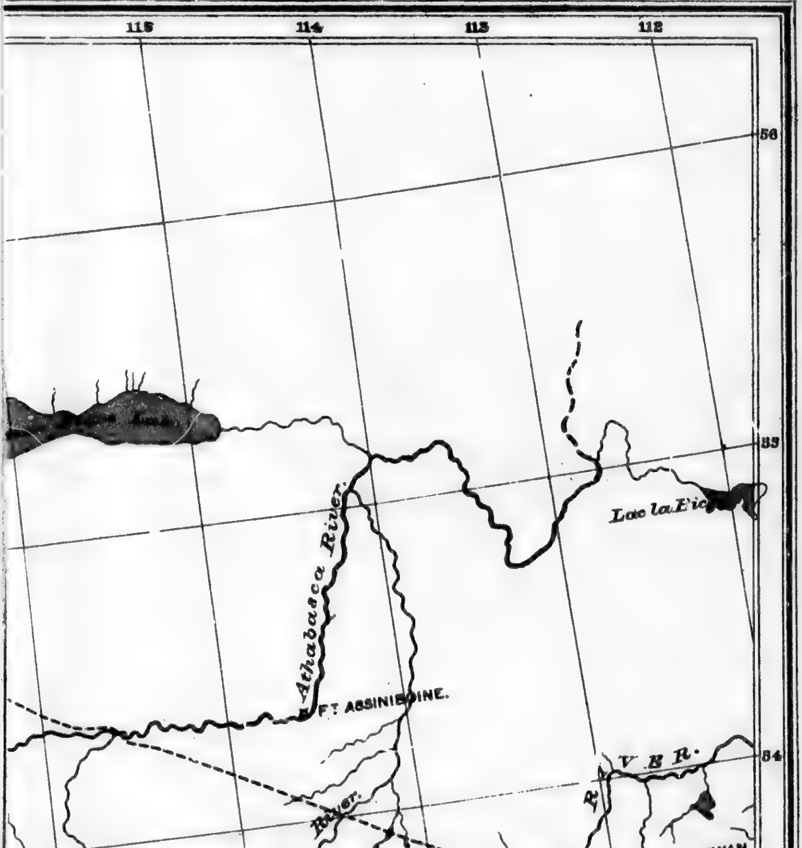


PHOTO LITH BY THE BURLAND LITH CO MONTREAL

*Railway*, 1880.

# CANADIAN PACIFIC RAILWAY.

## REPORT

BY

## THE ENGINEER IN CHIEF,

ADDRESSED TO

## THE HON. THE MINISTER OF RAILWAYS AND CANALS, CANADA.

CANADIAN PACIFIC RAILWAY,
OFFICE OF THE ENGINEER-IN-CHIEF,
Ottawa, 8th April, 1880.

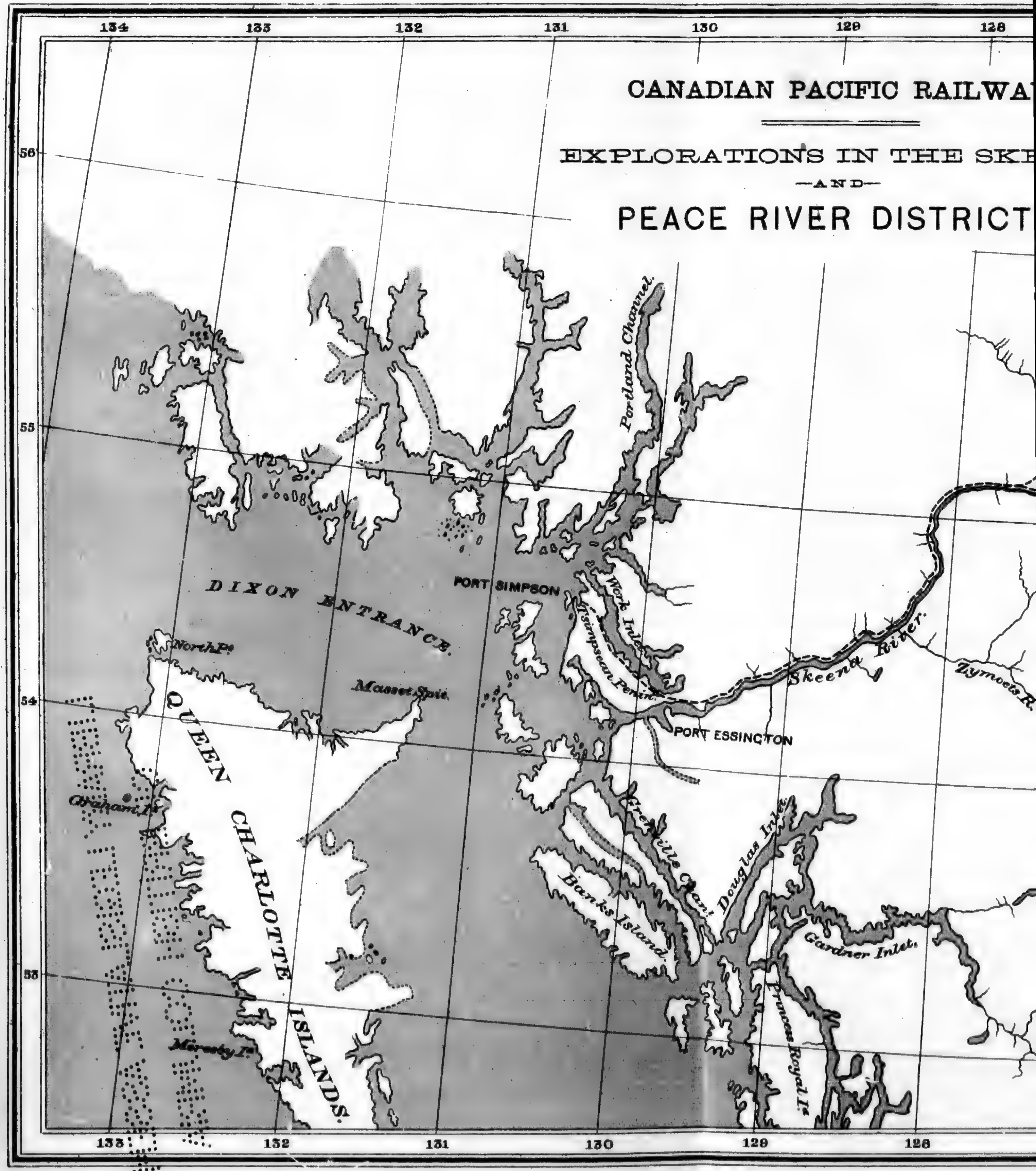
The Honorable
Sir CHARLES TUPPER, K.C.M.G., C.B.,
Minister of Railways and Canals.

SIR,—I have the honor to report on the various surveys and examinations made during the past season, and on other matters in connection with the Canadian Pacific Railway.

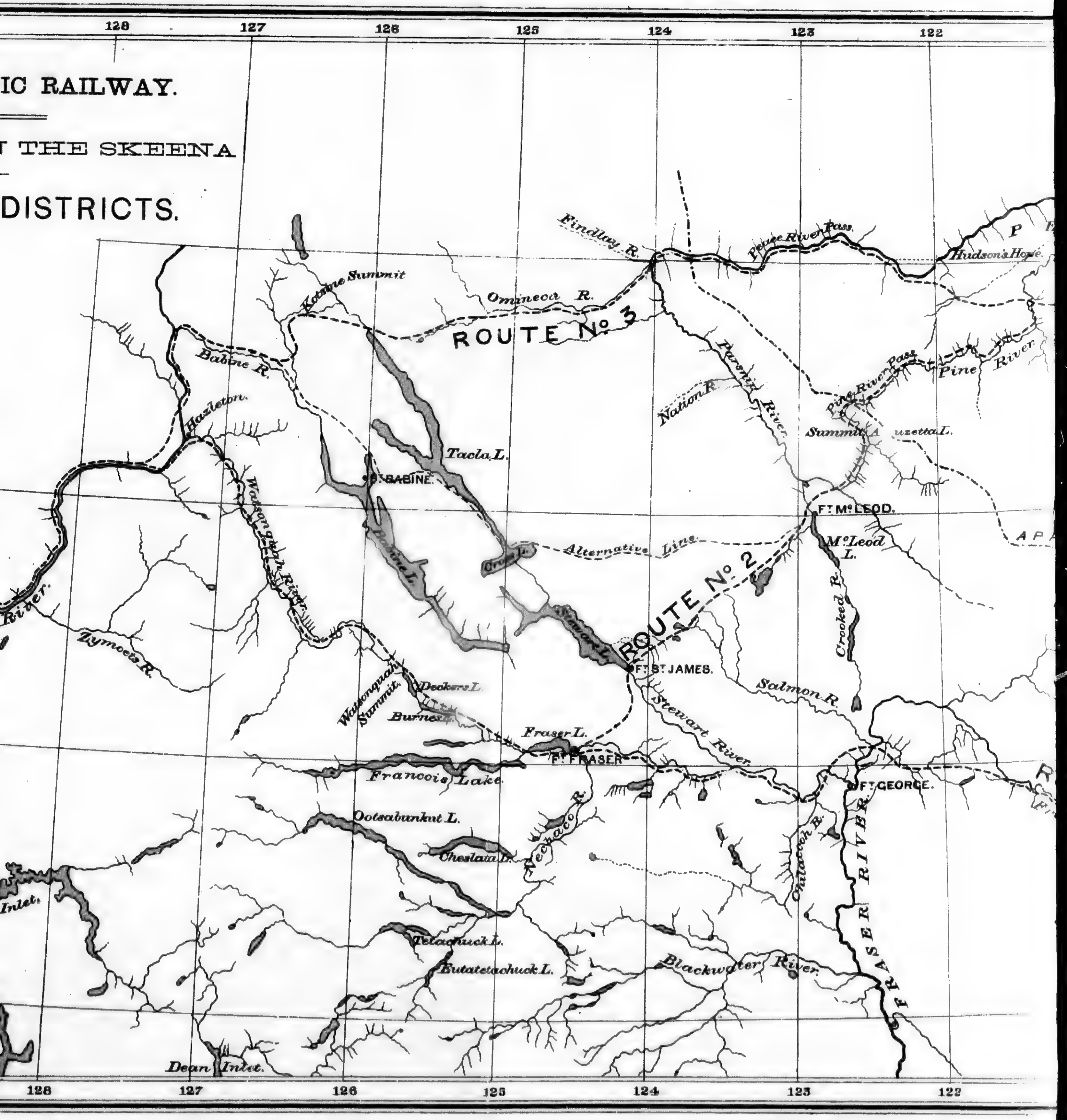
These several points have been briefly reviewed by me in the form required for the general report of the Department to be laid before Parliament. It now becomes my duty more fully to discuss them.

### EXPLORATIONS IN NORTHERN BRITISH COLUMBIA AND THE PEACE RIVER DISTRICT.

In the reports which, from time to time, I have had the honor to make, I have submitted, with the explanatory detail, the information obtained respecting the several routes to the Pacific Coast, and the character of the harbors which have been proposed as suitable for the terminus.


CANADIAN PACIFIC RAILWA

EXPLORATIONS IN THE SKE
—AND—
PEACE RIVER DISTRICT


IC RAILWAY.
THE SKEENA
DISTRICTS.
128
127
126
125
124
123
122
Findlay R.
Peace River Pass.
Hudson's Hope.
P
Kotaine Summit
Omineca R.
ROUTE No 3
Babine R.
Hazleton.
Nation R.
Parsnip River
Pine River Pass
Pine River
Summit
Azuzetta L.
Tacla L.
Ft. BABINE.
FT. McLEOD.
McLeod L.
APA
Alternative Line.
Crooked R.
ROUTE No 2
Babine L.
Stewart L.
Watsonquah River
River
Zymoets R.
FT. ST. JAMES.
Salmon R.
Watsonquah Summit.
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Burnes L.
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FT. FRASER
Stewart River
FT. GEORGE.
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Francois Lake.
Ootsabunkut L.
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Cheslata L.
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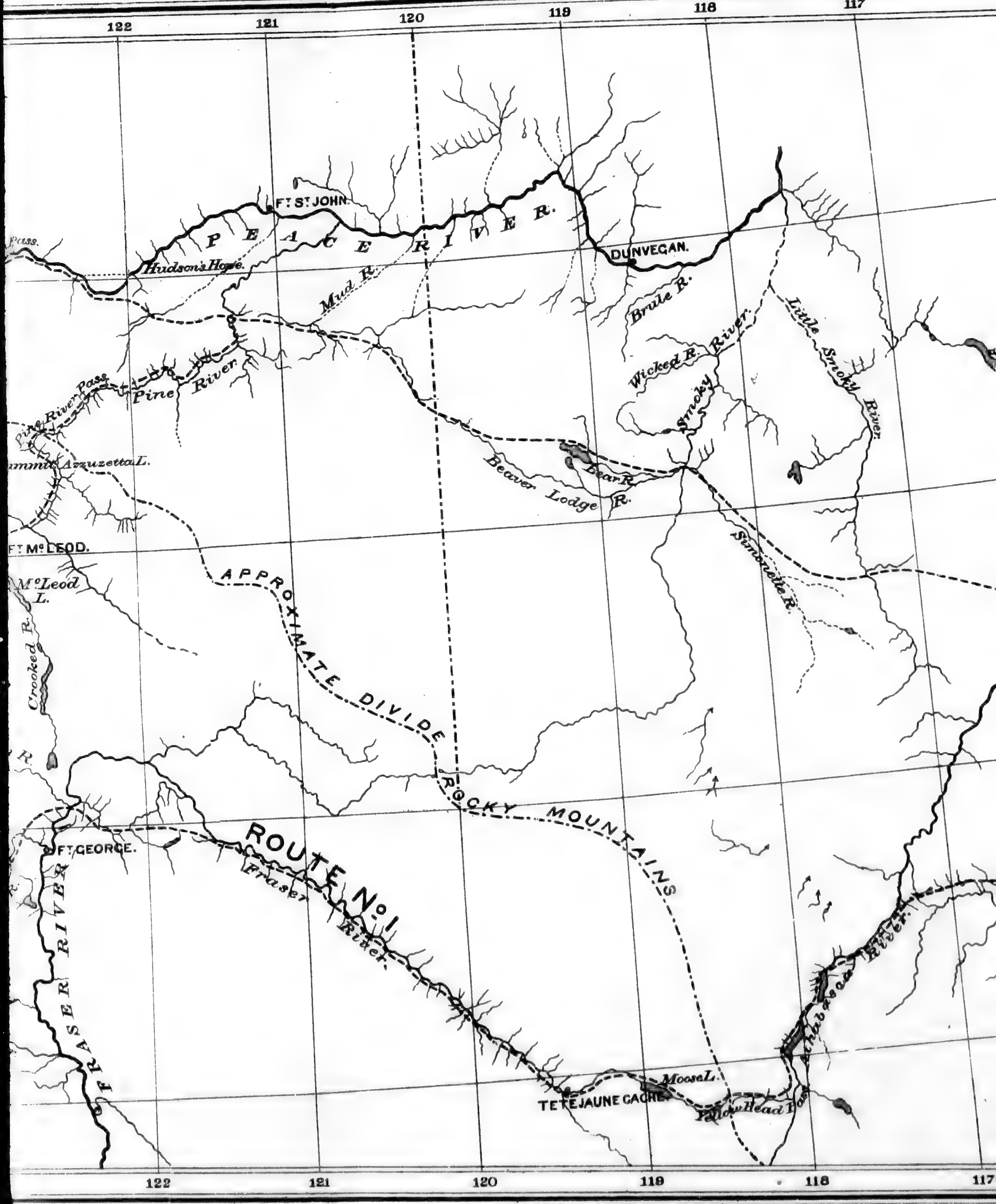
Pl


122
121
120
119
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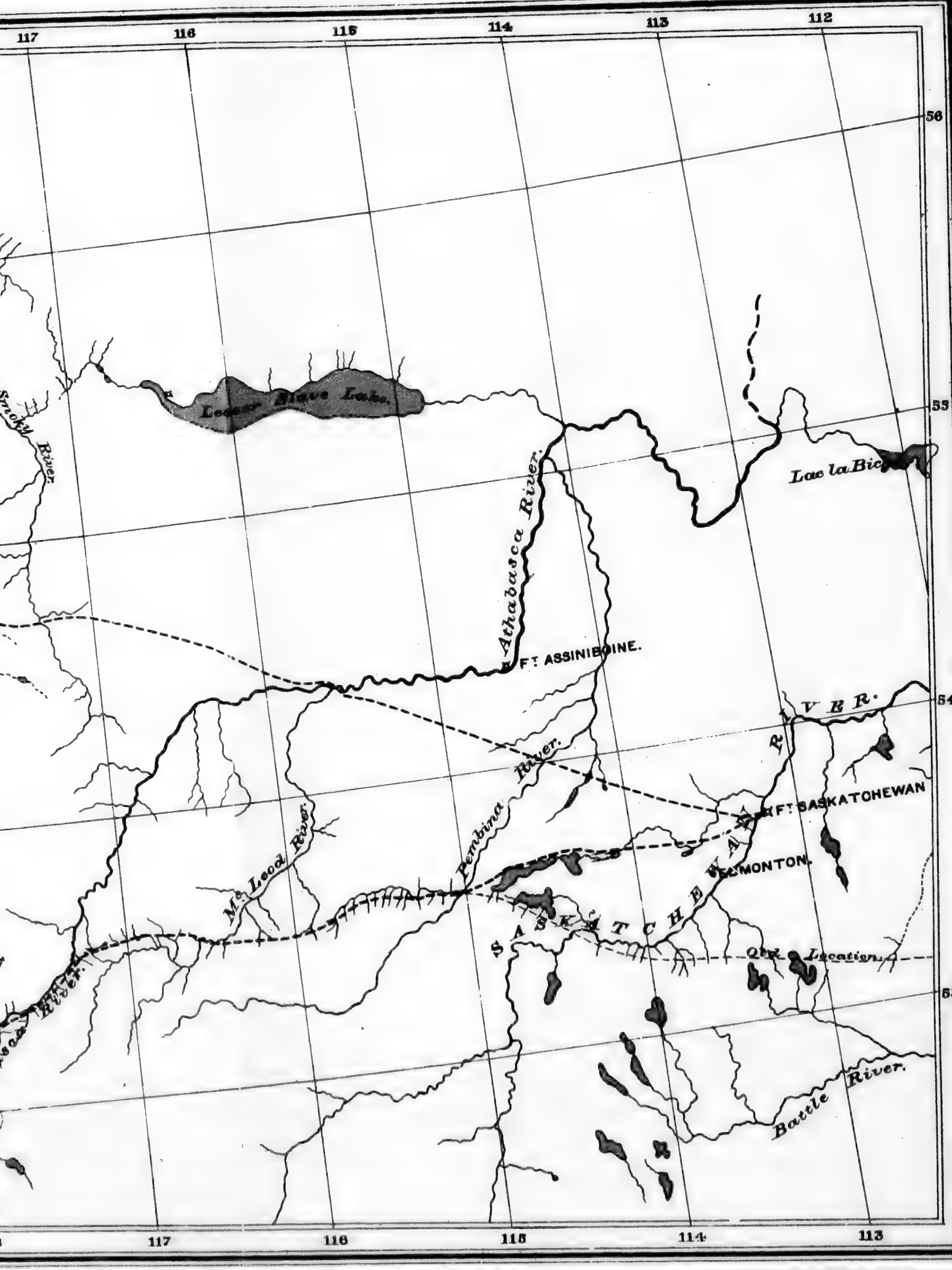
117
PEACE RIVER.
FT. ST. JOHN.
Hudson's Hope.
Pass.
DUNVEGAN.
Mud R.
Brule R.
Little Smoky River.
Wicked R.
Smoky River.
Pine River.
Pine River Pass
Summit
Azzuzetta L.
Bear R.
Beaver Lodge R.
Simonette R.
FT. McLEOD.
McLeod L.
Crooked R.
APPROXIMATE DIVIDE
ROCKY MOUNTAINS
FT. GEORGE.
ROUTE No. I
Fraser River.
FRASER RIVER
Moose L.
TETE JAUNE CACHE.
Yellow Head Pass
Athabasca River.
122
121
120
119
118
117

**Plate No. 1.** *To accompany Report of the Engineer-in-Chief, Canadian Pacific Railway, 1880.*



It was early seen that the Yellow Head Pass offered more than usual advantages for a line of railway crossing the Rocky Mountains, and that according to the information we possessed, that pass might be held to be a definite governing point by which the whole location would be controlled.

The most persistent efforts were made for several years to discover a line running directly west from Yellow Head Pass to the coast. They were fruitless. It was eventually established, that on the railway reaching Tête Jaune Cache, a point some fifty miles west of the Yellow Head Pass, two routes only could be advantageously taken.

The one, following a north-westerly course to a point near Fort George, turned south-westerly to gain the Valley of the Homathco, by which it found a passage through the Cascade Range to tide-water at Waddington Harbor. From Waddington it was projected to follow the rocky and precipitous side of Bute Inlet, and it was proposed to form a connection with Vancouver Island across the Strait of Georgia. Three subsidiary lines were suggested in connection with this route. One to leave the line near Fort George, and to run to Dean Channel; the second on a more westerly course to reach the Pacific at Gardner Inlet; a third following a north-westerly direction, to find an outlet by the Valley of the River Skeena. Of these four lines, the location which led to Bute Inlet, as giving assurance of a possible railway connection with Vancouver Island, was the only one which obtained any general local support.

The second line, on leaving Tête Jaune Cache, followed the Valley of the Rivers Albreda and Thompson to Kamloops, and proceeded by Lytton at the junction of the Thompson with the Fraser, descending the Fraser to Burrard Inlet.

Although the Yellow Head Pass was recognized as an important objective point affording an easy entrance from the east into British Columbia, through mountains previously pronounced impenetrable, the more northern passes of the Peace and Pine Rivers attracted attention, and opinions were expressed that they offered a natural passage for the railway through a fertile district with a salubrious climate.

This territory had been partially explored. Sir Alexander Mackenzie discovered the Peace River, and traced it to its source in 1793. Sir George Simpson followed it in 1828. Its general features accordingly were to some extent known. The first examination under my direction was made in 1872, when I passed over the line from Lake Superior to the Pacific. In August of that year, when at Fort Edmonton, I detailed Mr. Horetzky and Professor Macoun to proceed by way of Peace River to the Pacific Coast, to investigate as far as practicable the physical character of the region, and to obtain information respecting the nature of the soil, the *flora*, and the climate of the country examined.

A second exploration of portions of the northern district were made in 1877. The River Skeena was followed by Mr. Cambie from its mouth to the country drained by its south branch, the Watsonquah. The examination terminated at Fort George. The mountains themselves were crossed by Mr. Hunter in the same season by the Pine River Pass.

There was this distinction between the examinations of the routes to Bute Inlet and to Burrard Inlet, and the northern Peace and Skeena route. The two former had been surveyed in the usual form in which preliminary and location surveys are carried on, and definite data respecting them had thus been obtained; while the passes of the Peace and Pine Rivers had been explored only in a general way, as a reconnaissance, and the information obtained was consequently limited.

In my former reports I submitted the results of these examinations, and the characteristics of the several routes examined.

My own views on the selection of a route were thus given in 1878:—"Upon carefully viewing the engineering features of each route, and weighing every commercial consideration, I am forced to the conclusion that, if these alone are to govern a selection, if a decision cannot be postponed until further examinations be made, if the construction of the railway must at once be proceeded with, the line to Vancouver Island should, for the present, be rejected, and that the Government should select the route by the Rivers Thompson and Fraser to Burrard Inlet."

The subject was again alluded to in my report of 1879:—

"Much has been said for and against every route that has been projected, but on carefully considering the engineering and commercial features in each case, the conclusion was forced upon my mind that the railway itself would be least difficult to construct, that when established it would be easiest operated, and that general interests would be most consulted, by following the route to Burrard Inlet."

I was aware that this opinion would not meet with general favor, and in the last-named report I proceeded to say:

"It cannot be said that the selection of Burrard Inlet as a terminus, has given general satisfaction in British Columbia. On the contrary, a claim has been advanced in that Province that another route and terminus are preferable. It is therefore to be considered if additional explorations should be made and more complete information obtained with regard to the northern country, so that it may be definitely determined if a route more desirable can be found. Accordingly I suggest that the unexplored region, lying between Fort Connelly and Fort McLeod, in British Columbia, and those large tracts of vacant territory east of the Rocky Mountains, in the latitude of Peace River, which have never yet been traversed by scientific travellers, be explored and accurate data obtained respecting the feasibility of a railway through that region to the Pacific coast."

The Burrard Inlet route was known to be marked by many difficulties, and to involve an enormous outlay, but with all the disadvantages which it presents, I considered that it was entitled to the preference.

For six consecutive years, and at an exceptionally great cost, unremitting and systematic efforts had been made without success to find a better and less expensive line. Indeed there seemed no alternative but the adoption of that route, unless further examination of the northern country made it apparent that a better and more eligible location could be found under conditions so favorable that it would command ready acceptance.

Owing, in some degree, to the fact that the northern districts of British Columbia are remote from the areas of population, a northern route obtained but little attention during the early stages of the survey. It was only when it was found that no line could be secured in the more southern latitude, except at great outlay, that a northern route came prominently into notice, and that more extended examinations became desirable.

It was a serious responsibility for any engineer to assume to recommend that construction should be commenced on the line to Burrard Inlet, without first having exhausted all the sources of inquiry open to us. I felt that we should clearly and unmistakeably understand the capabilities and possibilities of the northern region; that we should obtain data to determine if a railway line could be obtained through it; that we should know the character of the route, and that we should possess full information with regard to the climate, soil and capability for settlement, before the Government became irrevocably committed to the large expenditure attendant on the adoption of any route.

It is easy to be understood that if, subsequently to the construction of the railway on the southern route, it should be discovered that a northern line could have been undertaken at a greatly reduced cost, and through a country, in respect of soil and climate, suitable for prosperous settlement, a gross and irremediable error would have been committed, possibly ever to be deplored.

Additional northern explorations, therefore, seemed to me to be advisable, whatever the result obtained. Under any circumstances, it was evident that the information gained, even if of negative value, would be important in adding to our positive knowledge of the territory

In April last, I was notified that the Government had decided, previous to the determination of any route, to make additional examinations of the northern passes, and of the country which flanks both sides of the mountains.

These examinations it was proposed so to carry on that the information would be systematically and rapidly gained; that it could at once be acted on, and the choice of the location and the commencement of construction be no longer delayed.

The extent of territory embraced was the country between the longitude of Edmonton, east of the Rocky Mountains, and Port Simpson, on the Pacific. Port Simpson had already been reported to be an excellent harbor. It was known that a deep-water arm of the sea, named Wark Inlet, some 35 miles in length, extended to the east of Port Simpson, in the direction of the River Skeena; Wark Inlet being separated from the Skeena by a narrow isthmus of no great elevation.

The objects of the examination were to discover the most favorable route from the coast to the Peace River District, on the eastern side of the mountains, and thence to the line already located near Edmonton; to gain full information with regard to Port Simpson, its advantages and disadvantages as a harbor; to verify the reports as to Wark Inlet being navigable by ocean sailing ships; to ascertain how far the country lying between the head of that sheet of water and the River Skeena, and the Valley of the Skeena itself were suitable for a railway line; and to obtain such definite information respecting the nature of a portion of the line accessible to steamers from the ocean, as would admit of a contract for construction being at once let, in the event of a northern route being chosen.

This examination really involved the determination of the problem whether the choice of the Burrard Inlet route should be sustained or abandoned; and if construction should be immediately commenced on the southern or on a northern line.

The service was consequently one of importance. The instructions to the officers selected, together with their reports, are given in full in the appendix.*

As time was an element in the problem, it was arranged that the examinations should be energetically carried out, and that so soon as the information was obtained, a synopsis of it should be sent by telegraph from Edmonton to Ottawa. Before the end of September the information was received and laid before the Government. On the 4th of October, an Order in Council was passed ratifying the adoption of the route *viâ* the Yellowhead Pass to Burrard Inlet, and I was directed to take steps for immediately placing under contract 125 miles of the most difficult portion, from near Yale to Savona's Ferry.

The examinations made during the past season have established that Port Simpson is a commodious, well-sheltered harbor. It has a large area of smooth water anchorage; it is to some extent exposed to south-west winds, but the roll of the ocean is broken on the reefs which here form a natural breakwater. It has good approaches, and is easy of access at all conditions of the tide. †A railway can be carried from Port

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* *Vide* Appendix No. 1, page 31, Instructions.
" No. 2, " 38, Report by Mr. H. J. Cambie.
" No. 3, " 57, " Mr. H. A. F. Macleod.
" No. 4, " 71, " Mr. George A. Keefer.
" No. 5, " 75, " Mr. Charles Horetzky.

† *Vide* Appendix No. 11, page 153, Notes on an examination of the Northern Coast and Harbors, B.C., by Capt. Brundige.

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Simpson, by way of Wark Inlet, to the River Skeena, and thence by the valley of that river, a distance of 180 miles, to Hazelton at the Forks. A trial location of 60 miles of the line was made from the navigable waters of Wark Inlet, plans and profiles were prepared, and approximate quantities computed, with the view of placing a section under contract, had a northern route been adopted.

From Hazelton several practicable routes can be obtained eastward.

*No.* 1.—On leaving the Forks, this route follows the River Watsonquah to its head, and by a tributary it reaches the main River Fraser near Fort George, whence it follows that river to Tête Jaune Cache, where it intersects the line located by the Yellow Head Pass to the prairie region.

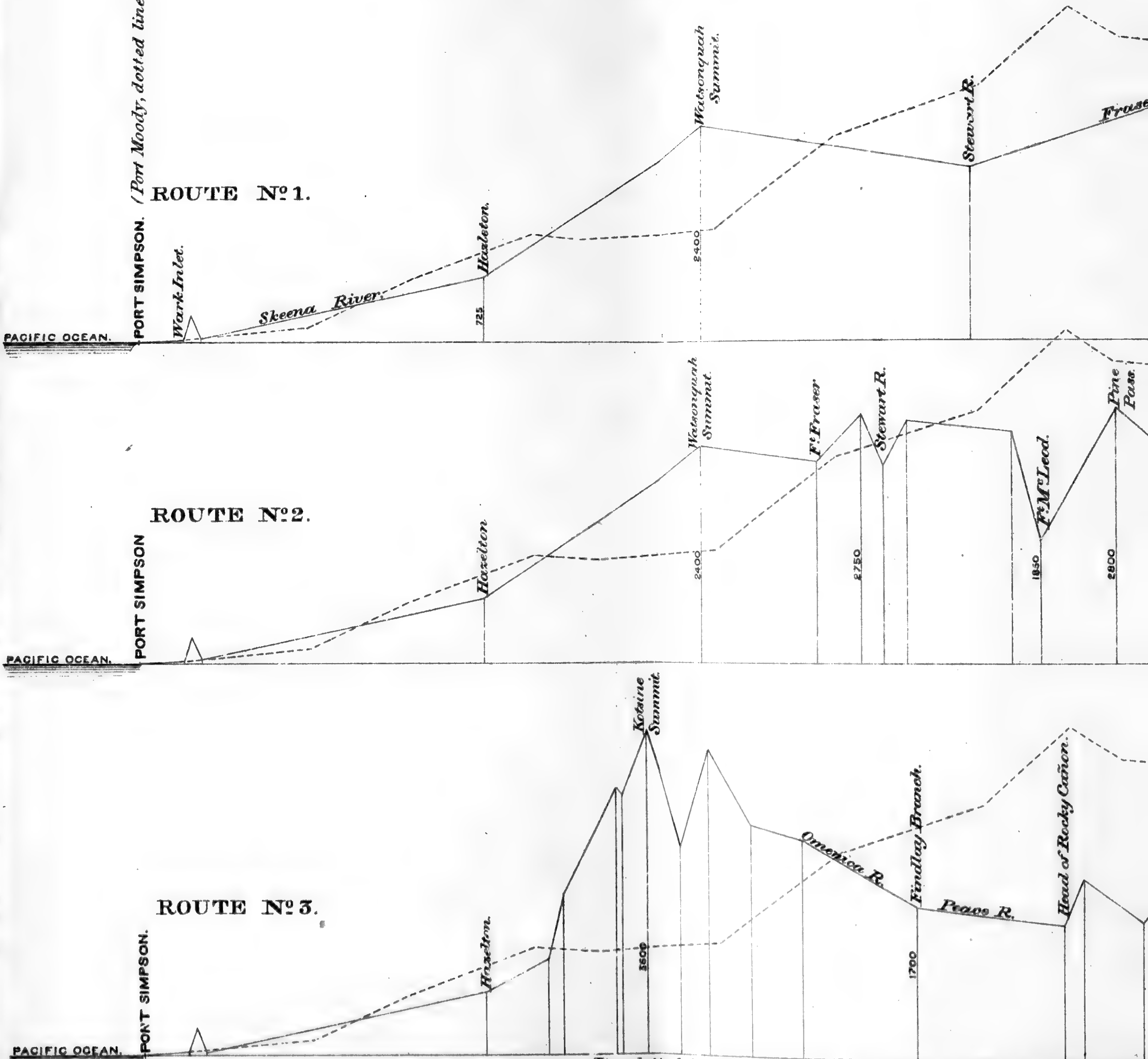
*No.* 2.—Follows in the same course, the Watsonquah Valley, to Fort Fraser, at which point, deflecting from the route above described, it runs north-easterly, *viâ* Fort St. James and Fort McLeod, to Pine River Pass, and thence eastward across the Peace River District.

*No.* 3.—Ascends the Skeena above the Forks about 33 miles; thence by the River Babine and the Kotsine Pass, crosses Driftwood River. It then passes over a second divide and follows the Omenica River to Peace River Pass, and thence pursues a course to join No. 2 on the plateau of Peace River.

Possibly a fourth line may be available by branching from No. 3 a little to the north of Babine Lake, running towards that lake to Fort Babine, crossing over to Tacla Lake, and following the valley of Middle River to Trembleur Lake, from which point it may be carried by the Nation and Parsnip Rivers, or possibly more directly by Fort McLeod, to Pine River Pass.

It is considered that, although the information is of a general character, the three first routes have been established to be practicable. The relative elevations attained on each is shown on the sections (Plate No. 2). The distance by each as compared with the line to Burrard Inlet, is roughly estimated as follows :—

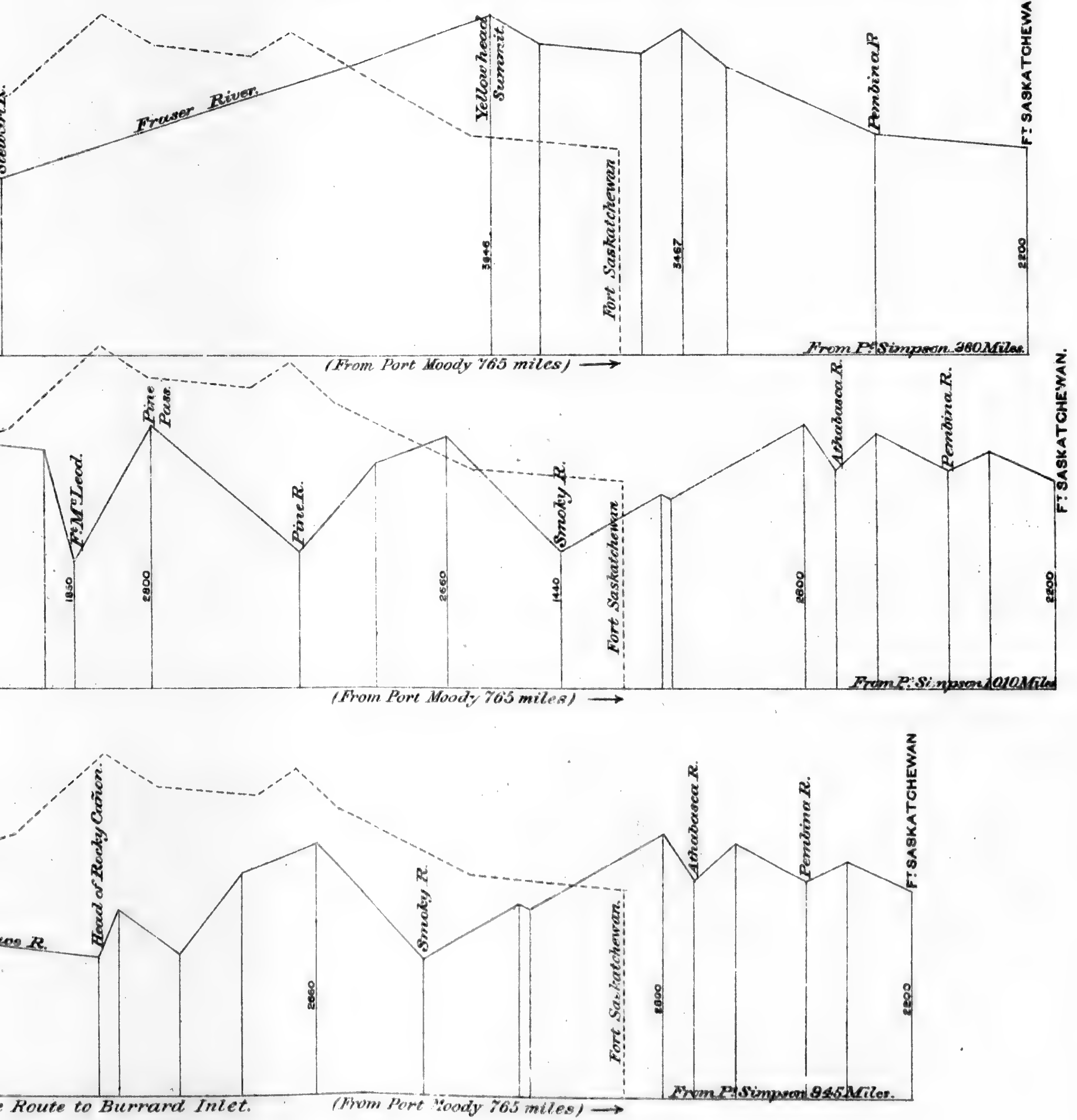
|  | Miles. |  |
|---|---|---|
| Lake Superior to Port Moody, Burrard Inlet........... | 1,945 | (measured.) |
| " to Port Simpson by No. 1.............. | 2,170 | (estimated.) |
| " " " 2................. | 2,200 | " |
| " " " 3................. | 2,135 | " |



*The dotted line in each case indicates the Route to Burrard*

PHOTO LITH BY THE BURLAND LITH CO MONTREAL

**Plate No. 2.** *Referred to in Report of Engineer-in-Chief, Canadian Pacific Railway,* 1880.



Accordingly, the shortest of the three northern routes, is that by Peace River. Starting from a common point, such as Fort Saskatchewan, east of the mountains, all exceed in length the line to Burrard Inlet.

To Port Simpson, *viâ* Peace River Pass, is.... 190 miles longer.
" " " Yellow Head Pass, is.... 225 " "
" " " Pine River Pass, is....... 255 " "

All are equally affected by climatic considerations, which, in this latitude, are of paramount importance. There is no difference of opinion among the explorers respecting the extent of fertile land. West of the Rocky Mountains it is inconsiderable. The fertile tracts are indeed the exception. To the east of the mountain chain the Peace River plateau is marked by great fertility of soil over a wide area.

The Peace River region, as far as examined, may be considered to extend from the foot hills of the Rocky Mountains easterly to Lesser Slave Lake, and from latitude 54° to latitude 57°. The whole area within these boundaries is not fertile, but they set forth generally the limit within which the region of fertility is found. To the north of this, however, bordering the valley of the Peace River, even to latitude 59°, there is a considerable tract of country that is reported to be fertile; but, as this northern district, though properly speaking included in the Peace River country, has not yet been examined, and as it was not embraced in the explorations of the past season, it is not here further referred to.

The fertile district is described as a plateau elevated generally about 2,000 feet above the sea. The rivers which pass through, or have their sources in the Rocky Moutains, and which drain the plateau, run in deeply eroded channels, ranging in many places from 600 to 700 feet below the general level. Peace River itself rises in Northern British Columbia and flows through the Rocky Mountains by a low passage about latitude 56°. It is described as a noble stream, indeed one of the most beautiful of rivers. It is fed from the south by a number of tributaries, the chief of which are Pine River and Smoky River, its confluence with the former being about longitude 120° 30', and with the latter about three degrees further east.

West of Smoky River, both to the south and north of Peace River, there are extensive areas of prairie country, either perfectly open and covered with more or less luxuriant grass, or dotted with patches of copse and trees.

The remainder of the surface is generally occupied by second growth forest, more or less dense. Some patches of the original forest remain, particularly in the river valleys. They are composed of much larger trees, chiefly coniferous, among which the black spruce is most abundant. Handsome groves of old and large balsam poplars are also to be found in some of the valleys. Though a large proportion of the prairie land is immediately available from an agricultural point of view, much of the region now covered with second growth and forest will eventually be equally valuable.

East of the Smoky River and southward towards the Athabasca, the prairie country is insignificant in extent, the region being characterized by second growth woods in every stage of development.

The largest tract of poor land is that bordering the valley of the Athabasca. South of Lesser Slave Lake it rises to a considerable height. This region is also very swampy in many places, and for a width of 20 to 25 miles on the trail from Sturgeon Lake to the Athabasca is quite unsuited for agriculture, though in many places it would furnish good pasture were the timber cleared away.

To the northward, east of Smoky River, peaty and other swamps occupy part of the surface. Land of this character may be regarded as permanently unsuited for agriculture.

The luxuriance of the natural vegetation on the prairies is described as truly wonderful, and indicates not only the fertility of the soil, but the occurrence of sufficient rain-fall.

The explorers unite in the opinion that the fertile area is of great extent, and that the whole region is certainly well adapted for stock raising. But the explorations do not establish beyond question its adaptability for the systematic growth of the higher cereals. Cultivation has been attempted on a limited scale at the Hudson's Bay Forts, in sheltered spots in the valley of the Peace River, but no portion of the plateau has been placed under cultivation, with the exception of very limited areas in the vicinity of Lesser Slave Lake and of Sturgeon Lake. Sufficient data have not been obtained to admit of any reliable comparison between this district and the better known fertile portions of the North-West, and it would be premature to pronounce a positive opinion upon its grain-growing capacities, although the uncertainty which has always been felt in this respect has been partially removed by the experience of last season.

Dr. G. M. Dawson, of the Geological Survey, is of opinion that the ascertained facts leave no doubt on the subject of the sufficient length and warmth of the season to ripen wheat, oats and barley, with all ordinary root crops and vegetables. The only point which may admit of question is, to what extent the occurrence of late and early frosts may interfere with their growth. Last year summer frosts occurred at different times; they were severe in the latter part of August, and did considerable injury to the growing crops around some of the Hudson's Bay Company's Forts.

It is probable that the season of 1879 may have been exceptional, and that the average of other years may give more favorable deductions; but we cannot set aside data which have been obtained.

The evidence shows that throughout the whole country explored, summer frosts were experienced. The explorers spent the month of August in the Peace River district. The wheat patches around the Hudson's Bay Forts, at the bottom of the valley at Hudson's Hope and Dunvegan, were injured by frost. On the plateau there was frost on three occasions in August; on the 21st, at points a hundred miles apart, 12° and 14° of frost were recorded. No frost was experienced in August last year near Edmonton, a fact which suggests that the Peace River district cannot be considered equal to the Saskatchewan in point of climate. But it would be premature to assume that such is absolutely the case. As cultivation advances and drainage relieves the land from superabundant water, the climate may be modified.

It may be remembered that the meteorological phenomena of last year were at variance with experience in many parts of the world. In portions of the eastern hemisphere the humidity was excessive and unfavourable to agriculture. Influences, but little understood, may have intervened to give an impress less favorable to the character of the Peace River district than is warranted. The observations of a series of years may establish the perfect capability of this district for agricultural purposes; but we have not the facts from which we can generalize with confidence. While the fertility of the soil is a recognized fact, and it may hereafter be established that the Peace River region is well adapted for the growth of grain, its fitness for wheat culture is not yet fully confirmed; certainly not so fully as that of the Saskatchewan district to the south. There can, however, be no doubt of the fact that equally with the Saskatchewan it enjoys immunity from the devastating visits of grasshoppers.

Dr. Dawson has expressed the opinion that beds of coal of a workable character occur in different parts of the Peace River region. He describes the coal seams as occurring in two series of rocks. In the lower or Cretaceous zone, beds of good quality were observed at various points a little east of the mountains, the seams varying from a few inches to two feet in thickness.

Numerous instances of localities showing coal or lignite in the upper series are mentioned, the chief being in the valley of the Athabasca and its southern tributaries. A seam was observed at one place from nine to ten feet in thickness.

I submit the reports of the explorers with full detail in the Appendix; likewise notes of Dr. G. M. Dawson* on the agricultural capability, the climate, and the economic minerals of the district, together with a descriptive memorandum by the Rev. D. M. Gordon.†

As everything relating to the character of the soil and climate of every portion of Canada on the Pacific Coast, and its possibilities as a field for settlement is of deep interest, I deem it proper to embrace in the Appendix notes on the agricultural capabilities of Queen Charlotte Islands, furnished by Dr. G. M. Dawson,‡ and a report on the arable lands of Vancouver Island, by Mr. Joseph Hunter.§

The location of the railway being now definitely fixed and contracts awarded on the line to Burrard Inlet, there is no longer any necessity, in the interest of the railway, for continuing examinations in the northern districts. Many years must elapse before the great areas of available lands between Manitoba and the mountains are fully occupied, and by this period the capability of the Peace River District will have been tested. Meanwhile, the character and extent of railway traffic and its requirements will be known. The question will then present itself, how this traffic can best be dealt with: Should it be desirable to construct a branch to Peace River from some point on the main line east or west of Edmonton, the late examinations have established that such a line is perfectly feasible.

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* *Vide* Appendix No. 7, page 107, Report on the climate, agricultural value, economic minerals, etc., by Dr. George M. Dawson.

† *Vide* Appendix No. 6, page 86, Memorandum respecting northern B.C. and Peace River, by Rev. D. M. Gordon.

‡ *Vide* Appendix No. 9, page 139, Memorandum on the Queen Charlotte Islands, by Dr. G. M. Dawson.

§ *Vide* Appendix No. 8, pape 132, Report on the agricultural capabilities of Vancouver Island, by Mr. Joseph Hunter.

In former reports I have contrasted the Canadian Pacific Railway with the line running from New York to San Francisco. I now beg leave to submit a comparison with all the lines projected across the United States. The accompanying diagram (Plate No. 3) prepared from authentic information will establish beyond question, the advantages in respect to the leading engineering features which the line adopted to Burrard Inlet possesses. Of the four lines stretching across the continent, within the limits of the United States, no one is marked by general summits so low or gradients so moderate as the line to Burrard Inlet.

In the Appendix will be found notes on the route of the railway through British Columbia, by Major General Moody, R.E., formerly commanding the Royal Engineers in British Columbia, and forwarded to the Department. They give the views of this distinguished officer on the question of selecting Burrard Inlet as a terminus for the trans-continental railway.*

## EXPLORATIONS IN THE PRAIRIE REGION.

In my report of last year I submitted that the location, not only of the main line, but of all the subsidary lines in the North-West, should be the subject of earnest consideration, and that the location of all lines of communication, whether constructed and worked by private companies or not, should be directly controlled by the Government. I beg leave to repeat the recommendation.

In order that the Government may be in a position wisely to exercise the control over the railway system of the North-West, a broad general scheme should be laid down for future guidance. It may, perhaps, be impossible to adhere, in every respect, to any pre-arranged plan, however carefully it may be conceived, but it should

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* *Vide* Appendix No. 10, page 144, Notes on the route of the Pacific Railway through British Columbia, by Major General Moody, R.E.

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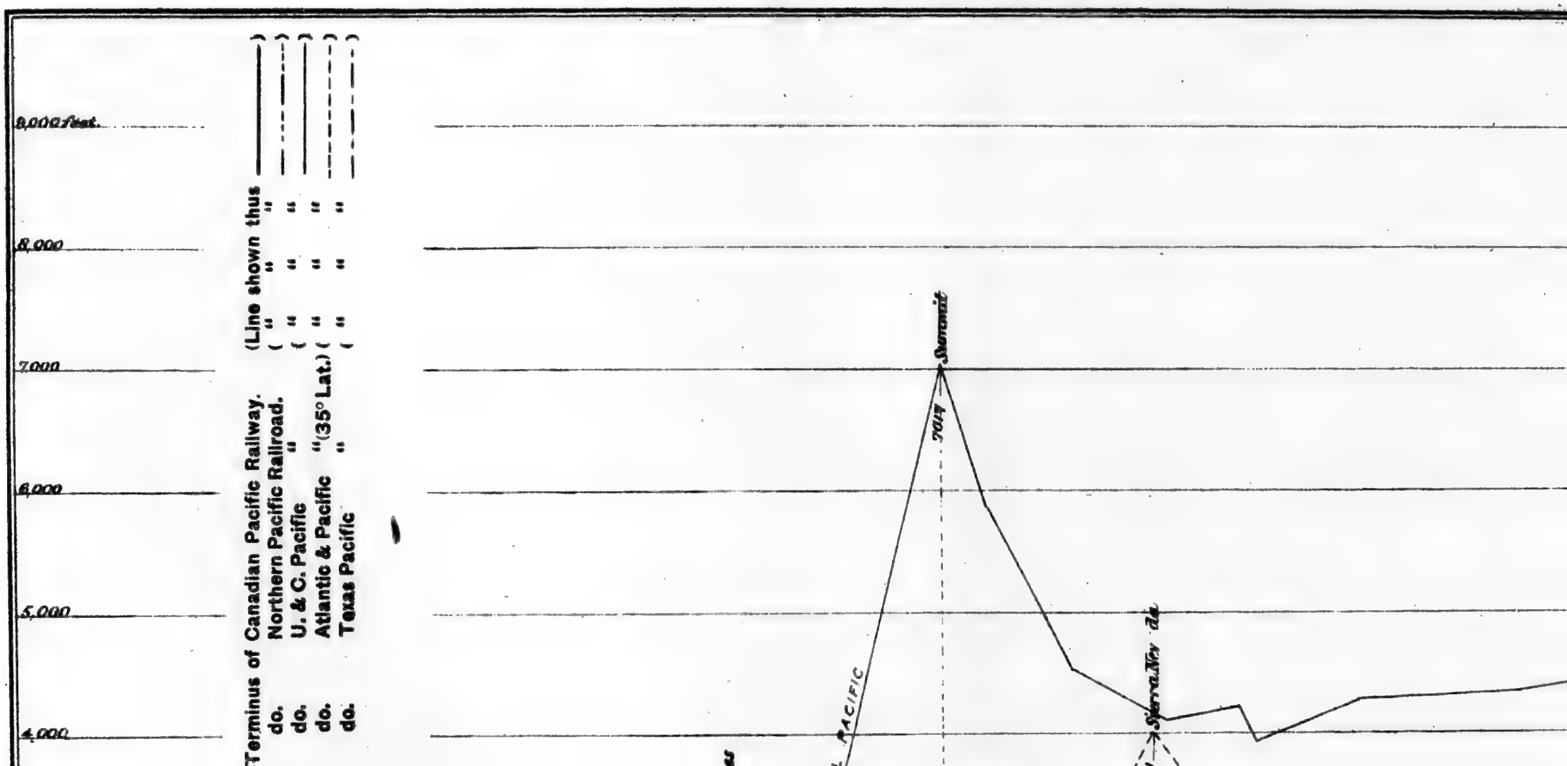

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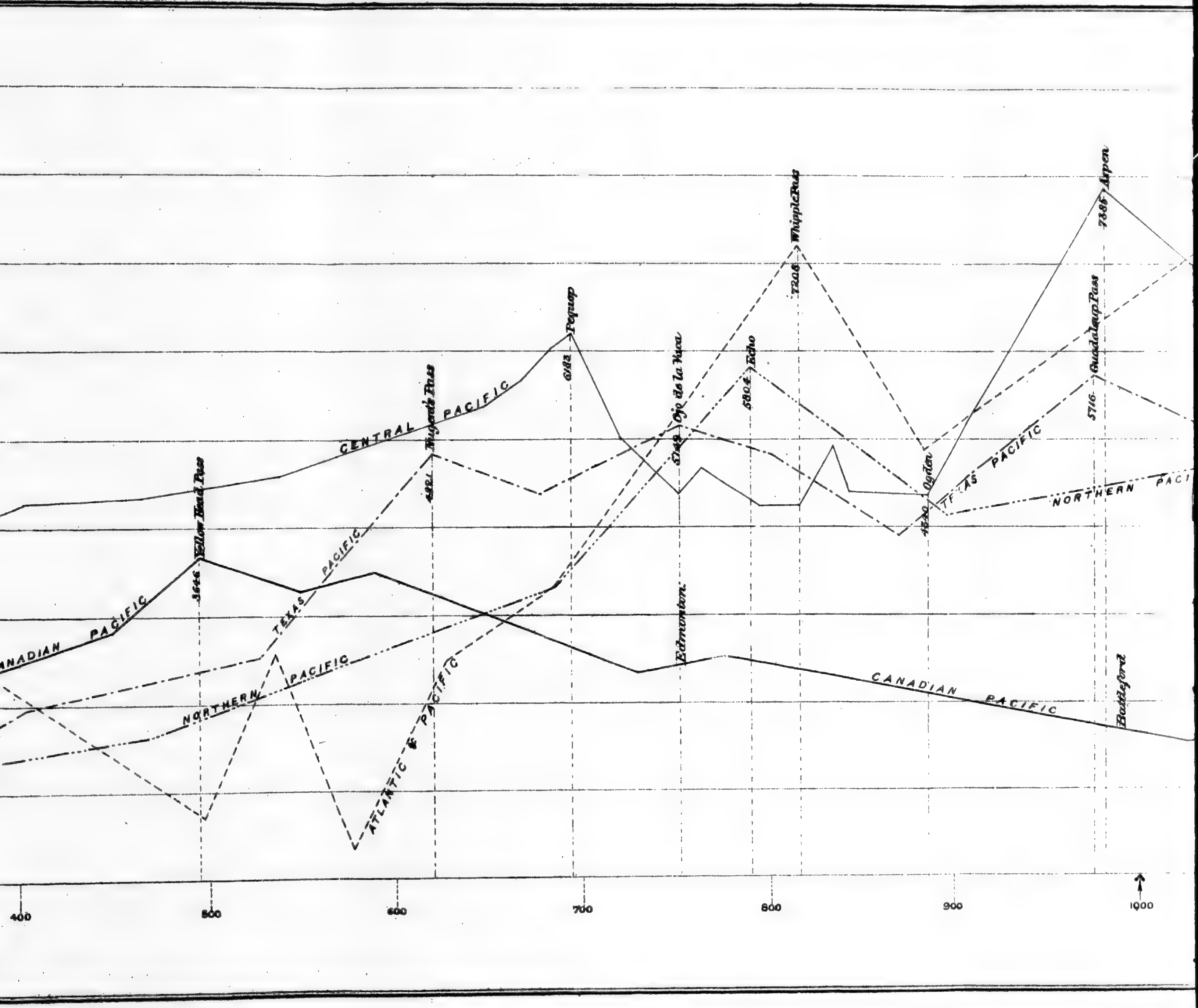
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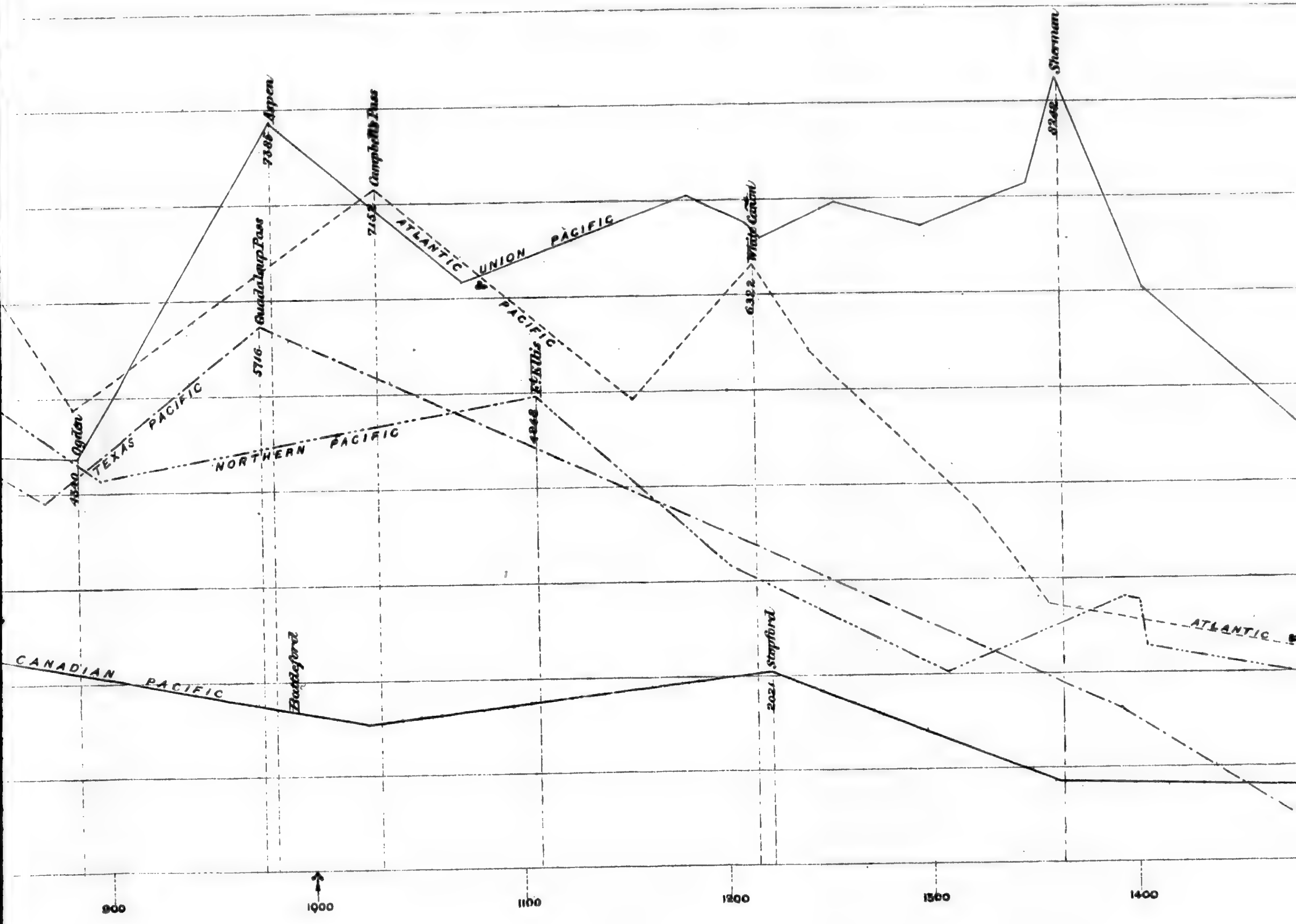
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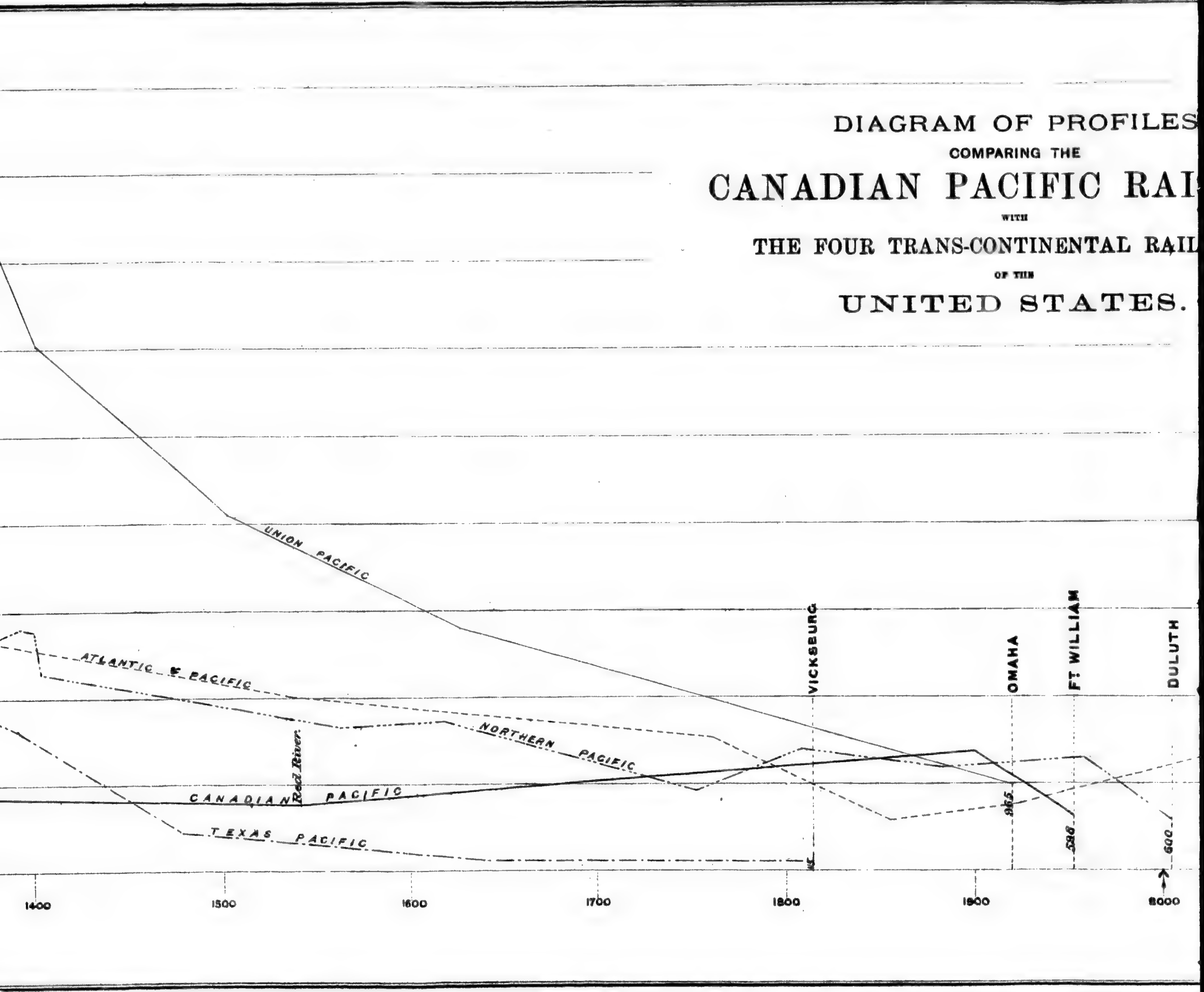
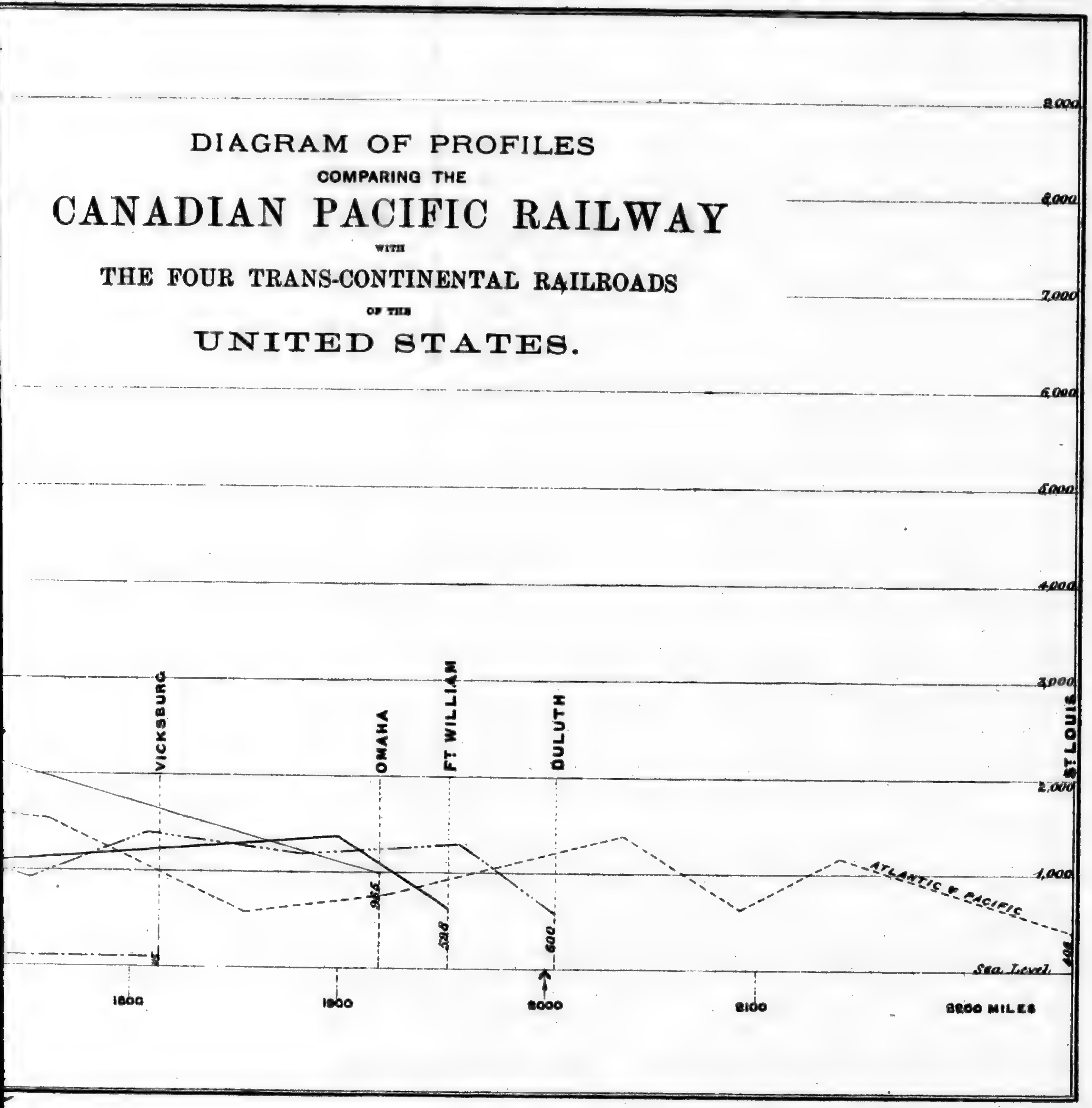
**Plate No. 3.** *To accompany Repor*

# DIAGRAM OF PROFILES
COMPARING THE
# CANADIAN PACIFIC RAI
WITH
## THE FOUR TRANS-CONTINENTAL RAIL
OF THE
# UNITED STATES.





# DIAGRAM OF PROFILES
COMPARING THE
# CANADIAN PACIFIC RAILWAY
WITH
## THE FOUR TRANS-CONTINENTAL RAILROADS
OF THE
## UNITED STATES.

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be the policy to follow it in its main features. The general interests of the country, and the people who are to occupy it, demand that efforts should now be made to determine the leading avenues of traffic. Any scheme will be inadequate unless it takes into view the country, with its capabilities and possible requirements as a whole.

The first step is to obtain general information respecting the principal features of the country, the character of the soil, the climate and its minerals. I pointed out last year, that although the prairie region had been seen by many travellers, and that the country east of the Rocky Mountains had been traversed on many trails, and a great deal of information collected, still the territory is of such vast extent that comparatively little of it was known.

I felt it my duty, therefore, to recommend that every effort should be made by additional explorations to gain information and gather data to admit of correct conclusions being drawn.

In conformity with my recommendation, these explorations were authorized. They included the country north of the 51st parallel of latitude, to the Churchill River district reaching the 56th parallel, and to the 57th parallel in the Peace River district. They extended from the Rocky Mountains easterly to the meridian which passes through Lake Winnipegosis.

The examination was divided into five sections:

1. Dr. John Smith was appointed to examine the tract north of the telegraph line, as it runs west of Northcote, included between the River Saskatchewan and Lake Winnipegosis.

Mr. D. C. O'Keeffe explored the tract bounded on the south by the River Saskatchewan, between Cumberland House and Carleton, on the west by the Hudson's Bay route, extending from Carleton northerly, *via* Lake Pelican to Isle à la Crosse; on the north by the Churchill River.

3. Mr. Eberts was detailed to the exploration of the district bounded on the south by the road from Carleton to Lac la Biche, on the west by the 112th meridian, and on the east and north by the Hudson's Bay route from Carleton *via* Lake Pelican and Methy Portage.

4. Professor Macoun was appointed to explore the country lying north of the 51st parallel of latitude, and south of the telegraph line from Livingstone to Edmonton.

The instructions to these gentlemen were to direct their attention more particularly to the districts on the map which had not previously been traversed and described, to make full and complete examinations, so that a knowledge of the physical character of the country should be obtained. The information was to embrace the nature of the soil, the subsoil, the extent of prairie and timber land, the character of the *flora*, the flow of rivers and creeks, and all points bearing on the water supply, the presence of economic minerals, and all features of importance.

Instructions were also given that a daily record should be kept showing the rainfall, the dew, the temperature and general condition of the atmosphere, and that all facts bearing upon the climatic conditions of each locality, and its fitness for agricultural purposes should be carefully noted.

These reports are too lengthy to be inserted in full, but synopses, amply explanatory, are given in the appendix. The general results may be thus stated.

The country examined by Mr. O'Keeffe, north of the Saskatchewan, west of Cumberland House to longitude 107°·30, is described as containing tracts of fertile soil, up to the 54th parallel; near the 106th meridian they extend half a degree further north.

The country within these limits generally produces in abundance all the various forest plants, and gives evidence of a prolific soil. A certain breadth is, however, diversified by sand ridges, lakes, marshy meadows, and muskegs. A stretch of sand hills and ridges, variable in width, commences about five miles north of the Saskatchewan, at Prince Albert, and extends eastward to within seven miles of Fort à la Corne. It is interspersed with belts of good rich land. East of Fort à la Corne the land immediately adjoining the river is for the most part sandy to the 103rd meridian.

Much fine timber was observed. In the south-western part, poplar copse prevails, gradually merging into continuous poplar forest, which attains its greatest development to the east of Stinking Lake. The balsam and poplar in groves is of large size, in many cases two feet in diameter.

Extending eastward from Stinking and Pelican Lakes fine groves of spruce are frequently mixed with aspen and balsam-poplar, and, on the borders of the swamps, groves of tamarac of all sizes up to 18 inches in diameter are found. Banksian pine is prevalent on the sand hills and ridges, but seldom attains a foot in diameter. Birch and willow are numerous, but of little value except for fuel.

A line, which generally may be described as running from Cumberland House along the 54th parallel to the 105th meridian and thence bending northerly to 54° 30' on the Beaver River, may be considered as the northern limit within which land, fairly good, is found.

North of this line up to latitude 55° the country consists of a series of large lakes, high sand ridges, rounded hills and wide stretches of bare sand with frequent marshes producing coarse grass. The only locality where good land was observed was some distance south of the Stanley Mission on Churchill River about longitude 104° 30'. Here some small patches were cultivated as gardens.

North of latitude 55° and extending to Churchill River the whole country is described as being absolutely barren consisting of Laurentian rocks with mossy muskegs, sandy wastes and numerous large lakes.

Banksian pines of small size, scattered over the rocks and here and there groves of small spruce in marshy spots were met with.

The exploration west of longitude 107° 30' was generally confined to the district extending from the Saskatchewan, north to Beaver River and to about thirty-five miles north of Lac la Biche.

Within these limits the country is described as varied in character. There are extensive portions covered with rich dark loam, capable of producing fine crops. Other tracts are sandy and poor; and to the east, south of Beaver River, a large extent of wet and marshy land is met.

The indications suggest that the whole of this district was originally forest; but at present a strip of from five to twenty miles along the Saskatchewan is chiefly prairie.

To the north large open tracts are interspersed through the forest land. The standing timber consists of poplar and spruce of good size with Banksian pine on sandy soil.

Mr. Eberts examined the country to the east and for 35 miles north of Lac la Biche. He reports the good land to terminate five miles north of the Lake.

From information obtained from various sources, he considers that the general northern limit of good land in this district may be taken as extending from about latitude 54° 30 in longitude 108° north-westerly to Lac la Biche in latitude 55°.

Of the country north of this line to Clearwater River and west to the Athabasca the only information is that obtained from the Hudson Bay officers and others who have hunted in the district. They describe it as sandy and marshy, with occasional tracts of alluvial land along the streams.

The country lying to the south of Lac la Biche and Lesser Slave Lake and between the 112th and 116th meridian has not been fully examined. Its character along the Saskatchewan and for some distance north and west of Edmonton is better known. This region has been traversed in two or three directions, but there are wide intervening spaces which remain unvisited.

It is generally a wooded district with some open prairie and copse wood, the latter chiefly bordering on the Saskatchewan.

To the south of Lesser Slave Lake the country is hilly and broken, and along the margin of the lake swampy. From the outlet of the lake south-east to the Athabasca the land is described as low with some tracts of good sandy loam. On the Athabasca the banks are more elevated, and as far as examined the soil is light and of a variable quality. It is covered here and there with luxuriant pasture and is generally lightly timbered. For about seventy miles north of Edmonton the country is described as in every way inviting, the soil is rich, with tall grass and pea-vine, well watered by streams and occasionally dotted with aspen copse. Approaching Edmonton the soil is exceptionally good with luxuriant hay meadows and gently rolling wheat lands of great fertility. Large fields of wheat were during the past year successfully cultivated in this quarter.

Much fine spruce with occasional birch of large size is found in the valleys of the Athabasca and its tributaries. The soil is chiefly sandy loam, but gravel ridges and sand hills intervene at various points.

The district extending west of Lesser Slave Lake is alluded to in the account of the explorations in Northern British Columbia and the Peace River region.

The section south of the Saskatchewan, east of Fort à la Corne, west of Lake Winnipegosis and north of the 52nd parallel, is described by Dr. John Smith.

The interior of this district remains still unexplored, but the Porcupine and Basquia Hills are known to occupy an extensive area, and are said to be covered with heavy forests of fine poplar, spruce and tamarac. To the east of these hills, and bordering on the Saskatchewan and Lake Winnipegosis there is almost a continuous marsh, but to the south-east of Porcupine Hills, on the Swan River, there is a large extent of fine fertile land. West of the Porcupine Hills, as far as the 103° meridian, the country, so far as examined, is flat, with extensive swamps and muskegs. Much of the soil is rich, and, where drainage is possible, will no doubt become of value.

Westward of the 103° meridian the country, although not free from swamps, becomes much drier. The soil is good and fertile, of a dark colored loam of great depth. In the valley of the Carrot River the land is exceedingly rich.

The district is generally covered with timber, except the south-west portion, which is prairie.

The district north of the Qu'Appelle and west of the Assiniboine is described as variable. Near the Assiniboine and Fort Ellice there is a poor and sandy tract. Further west the soil, although light, proves to be fair in quality.

To the east of Pheasant, File and Touchwood Hills there is a fine tract of land, principally prairie on the south and east, but gradually passing into a more thickly wooded and more elevated country to the north. The northern part of this tract is well watered with running streams, but towards the south, late in the season, water is obtained with difficulty.

Professor Macoun describes the soil as a rich black loam, about 15 inches in depth, containing small grains of quartz and limestone and other pebbles. Approaching the File and Touchwood Hills its character imperceptibly changes into lighter colored sandy loam. The subsoil, into which pits were dug at various points, is generally a light colored marly clay; in the ridges it passes into gravel, coated with carbonate of lime. Boulders are numerous in some localities, but at no points are they so crowded as to prevent successful cultivation.

West of these hills the rich soil does not terminate until it reaches the salt depression which extends from the head of Long Lake to the Quill Lakes. This salt plain is still undefined; but Mr. Macoun states that it is only a few hundred yards wide directly north of Long Lake, and about 12 miles in width where it is crossed by the trail from Carlton to Touchwood Hills.

It is probable that the creek which enters Long Lake at its north-eastern extremity may be the outlet of Quill Lakes, or was so originally.

Although in early summer the water on the Touchwood Hills is nearly all good, many of the pools in the isolated depressions, later in the season, are partially evaporated, and the residue in September and October becomes unfit for use.

The water in the salt depression, west and north of the Touchwood Hills, is generally, bad. Many fine streams of pure water enter the Quill Lakes from the north but the water of the lakes is always brackish and unfit for culinary purposes.

Firewood in sufficient quantities for the use of Settlers is found in the northern and eastern portions of the district, but in the south to the east of Pheasant and File Hills, it is scarce. The area to the west, with the exception of the hills, on which good timber for building purposes may be found, is altogether without wood.

The country north of the Qu'Appelle, as the South Saskatchewan is approached, appears to be characterized by extensive sandy tracts. This locality is comparatively arid. It extends northward along the South Saskatchewan for some distance, and about latitude 51° 30′ becomes hilly and broken.

The land is described as of little value as far north as the 52nd parallel. Further to the north the soil becoms of fair quality. Between latitude 52° 30′, or thereabouts, and Fort à la Corne, there is a large area of fine rich country, comparatively well wooded, and interspersed with ponds of fresh water.

At the Elbow of the South Saskatchewan, the sandy, arid tract referred to, may be said to extend westward about eight miles beyond the river and proceeding northward, it increases in width along the western side of the river till it gains the vicinity of the Elbow of the North Saskatchewan.

North of latitude 52° 20', between the two Saskatchewans, the country improves. It is described to be, for the most part, of light sandy loam, having frequently on its surface numerous boulders. Duck Lake settlement is situated in this tract, about midway between the rivers.

North-eastward the peninsula between the two Saskatchewans, becomes more rolling. It continues of a sandy loam for 18 miles from Duck Lake, when it merges into a ridge four miles wide, of almost pure sand. It is in this locality that the Prince Albert settlement commences, whence it extends for 22 miles. The country is of rich, dark sandy loam, interspersed with ridges, groves of timber, ponds and marshes.

Professor Macoun examined the great plains lying between the 51st parallel and Battle River, which extend from the 107th meridian to the 111th meridian.

These plains were at one time considered as of no value. They have been referred to frequently and described as little better than an arid desert. Recent explorations do not confirm these views.

The explorer traversed the southern part of this extensive district keeping about twenty miles to the north of the 51st parallel. He found the country without wood and comparatively level, until towards the west, when it became a series of rolling hills.

The soil is generally a strong friable clay, producing luxuriant grasses. Abundance of fresh water was generally found in July and August in ponds, but no running streams were observed. The eastern portion, to the north-west of Red Deer Lake, to the Bear Hills, about latitude 52°, is described as a country well suited for agriculture.

The Bear Hills and the western slopes of the Eagle Hills, although rough, contain some excellent soil, good pasture and abundance of fresh water. Wood in plenty is to be found on the Eagle Hills.

Mr. Macoun traversed the great plain south-westerly from Battleford towards the Hand Hills, and found a fertile and almost level plain extending for 40 miles south-west of the Eagle Hills; the country here became rolling and hilly, but no bad soil was met with until about the 111th meridian.

There yet remains a large extent of the Great Plains unexplored, but as far as seen east of the 111th meridian they are described as consisting of a strong rich clay or clay loam, on almost every locality examined.

Fresh water in pools was found throughout in August and September, and from plants found in the ponds, Mr. Macoun feels assured that the supply of water is permanent.

Only one creek of running water was seen on this plain. Many salt lakes or ponds were also found among the hills in the central and south-western portion. No signs of aridity caused by climate were observed. On every part of the tract south of latitude 52° excellent arable or pasture land prevailed.

North of the Neutral Hills about lat. 52° 10 and longitude 110° 30' and extending westward to within 5 miles of Battle River is a tract of poor sandy land, changing to the northward to good sandy loam.

Light and heavy sandy loam is the prevailing character of the soil between the 52nd parallel and Battle River.

Near Battleford there are sand hills covering a limited area. With this and some other exceptions the whole district is described as suitable for agriculture.

Exceedingly rich soil is found in the vicinity of Manito Lake some sixty miles to the west of Battleford.

For some distance to the west of the 111th Meridian and to the north and east of Red Deer River the country is arid, the soil being generally gravelly or sun-baked clay.

Several creeks of fresh water run through this district, there are also numerous alkaline marshes and ponds. The plains produce indifferent pasture. Artemisia and Cactus are prominent among the *flora* of this district.

Much of the soil on the Hand Hills about latitude 51° 30' and on the elevated lands generally is of fair character, with a growth of excellent grass. Ponds of good fresh water are frequent.

To the north or about the 52nd parallel the character of both the country and soil improves. Much good land and very fair timber is seen around Tail Creek between longitude 112° and 113.° The country extending north to Battle River is well suited for agriculture.] [To the eastward the soil is indifferent and the surface more broken but the country is suited for pasture.

The country north of latitude 52° is well watered with running streams, and contains more or less woodland, but the groves are no where continuous.

West of Red Deer River, in the direction of the Blackfoot Crossing, the country is level for several miles, becoming rolling and more broken to the southward as Bow River is approached.

The land between the two rivers is generally sandy loam and appears to have a light rain-fall.

A little west of the crossing within the Blackfoot Reserve is a range of sand-hills, which apparently extend south of the River.

From this point to about 20 miles west of Fort Calgarry, a distance of 80 miles, the land is described as nearly all fit for the plough on both sides of Bow River. On the north of the river between the Blackfoot Crossing and Calgarry, water was found difficult to obtain.

Approaching the Rocky Mountains the country becomes broken by high hills and terraced ridges, but the whole of this land, though rough, produces fine pasture and is well adapted for stock-raising.

Fort Calgarry is situated about latitude 51°, longitude 114°. Between that point and Edmonton the land for a very considerable breadth is generally a dark coloured clay or sandy loam well suited for agriculture, excepting where it is too wet. Much of this district north of latitude 52° is either covered with willow bushes or small poplar, with occasional groves of good-sized spruce and balsam poplar along the rivers.

The country between Battle River and the North Saskatchewan is described as generally good. The greater portion is well supplied with fresh water, with sufficient wood for fuel and fencing. There are localities where water is scarce and in other parts brackish.

The district between the Beaver Hills and Fort Pitt gives indications of being wet and requiring drainage. The same may be said of the vicinity of the Willow Hills, but taken as a whole, the country between Edmonton and Battleford consists generally of good agricultural land.

## *Timber.*

The country lying to the south of the 52nd parallel is devoid of timber. This disadvantage may be said to apply to the whole district extending westerly from the Touchwood Hills to the foothills of the Rocky Mountains, a distance of fully 400 miles. Within this space no wood is found except in the valleys of the large rivers and in a few gullies.

Much fine timber, consisting of spruce and Douglas pine, is found along the flanks of the Rocky Mountains, from whence it may be floated down many of the larger rivers. This timber should be carefully husbanded. In a few years it will be of immense value for building purposes to the Settlers on the plains.

## *Coal and Iron.*

On the North Saskatchewan at Edmonton, and further down the river near Victoria, coal of fair quality is known to exist. Exposures have been observed on this river as far as the Rocky Mountain House, and one seam of 18 to 20 feet is mentioned by Mr. Selwyn of the Geological Survey.

Mr. Macoun found coal 150 miles east of Rocky Mountain House on an affluent of Battle River. It is again seen 100 miles south and has been traced to the

Blackfoot crossing on Bow River, where there are seams from three to six feet thick. South of Bow River many fine seams have been found, and near Fort McLeod coal is now regularly worked.

Brown nodular iron-stone is reported from various localities in connection with coal and shales, but not as yet in workable quantities.

Details of the explorations conducted last season, describing the physical character of the Prairie Region examined, are arranged in systematic order in the appendix.* Professor Macoun has attempted to generalize the results obtained from all authentic sources in a separate report, also appended.† He estimates that between Manitoba and the Rocky Mountains there are at least 150,000,000 acres of land suitable for agriculture and stock raising.

### THE RAILWAY ROUTE WEST OF RED RIVER.

The railway route west of Red River, recommended in former reports, followed a course north-west from Selkirk, crossed Lake Manitoba at the Narrows, and skirted the northern spurs of the Duck Mountains; it passed through a depression in the elevated ground, and reached the prairie plateau near the source of the Assiniboine. This location is, however, abandoned. The Government have given the preference to a line which will pass to the south of Lake Manitoba, and follow the course of present settlement south and west of the Riding Mountains.

It was determined early in the season to place under contract the first 100 miles section west of Red River, including a branch to the City of Winnipeg. The extremely level character of the portion of the Province of Manitoba, to be traversed, rendered it an easy matter to carry the line in any direction. It was, however, an object to find a dry location, and to select a route which promised to be of greatest permanent advantage, and which would involve least charge for the right of way.

In June last, surveys were commenced to establish the route from the western boundary of the Province of Manitoba, and thence north-westerly towards the River

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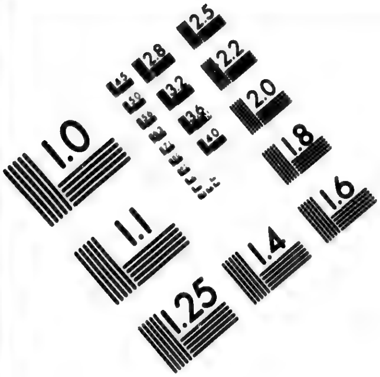
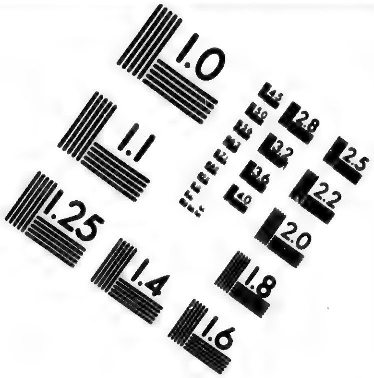
* *Vide* Appendix No. 13, page 169, Epitome of information from authentic sources, systematically arranged, by Mr. Thomas Ridout.

† *Vide* Appendix No. 14, page 235, General remarks on the land, wood and water, by Professor Macoun.





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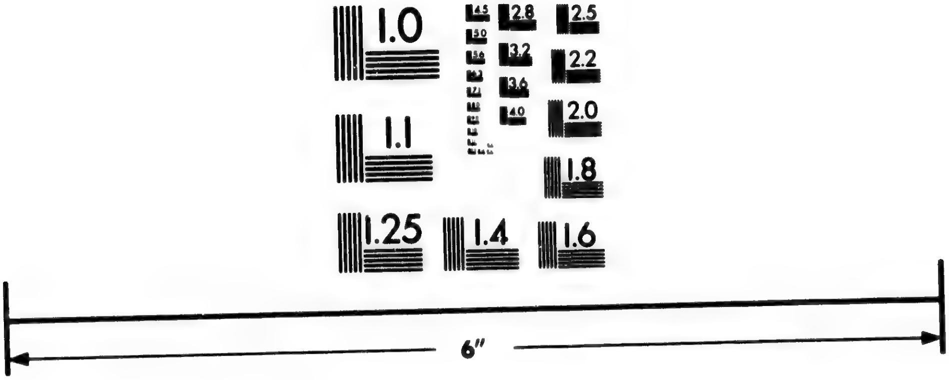

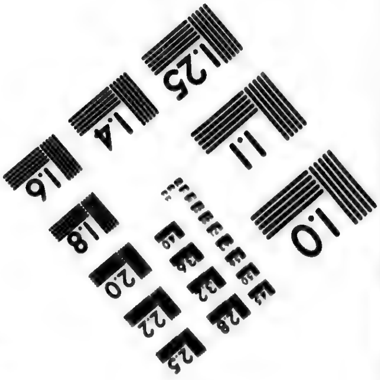

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Saskatchewan. A general reconnaissance of the district has been made, and two lines surveyed; one running west, and terminating four miles beyond Fort Ellice, on the Assiniboine; the second, on leaving the Province of Manitoba, taking a north-westerly course to Birdtail Creek. A third was projected to run from the common starting-point to the confluence of the Little Saskatchewan and the River Assiniboine. This line gave promise of favorable gradients on a section which ultimately might be used for coal traffic, but the first had the advantage in respect to mileage on the through route.

The Government held that it was more important to continue the line which followed the general course of settlement along the western slope of the Riding Mountain, especially as it proved to be 20 miles shorter than the southern route. The north-western route was therefore adopted by Order in Council, dated 22nd Jan. last, and tenders were invited for a second 100 miles section west of Red River. A description of the lines surveyed and projected is given in the appendix.*

During the past season Mr. MacLeod traced a route which will materially lessen the work and cost of the line between Battleford and Yellow Head Pass. On the old location there are difficulties of construction, of some magnitude, at the crossing of the Saskatchewan and its approaches, also at White Mud, Buffalo and Grizzly Bear Gulleys. He reports that the latter three can be entirely obviated and the main river crossed with greater ease by following a more northerly course west of Battleford to Fort Saskachewan, and then passing up the valley of Sturgeon River, finally intersecting the old line near the River Pembina. When construction approaches this section the deviation can be kept in view and the location amended.

### BRIDGING RED RIVER.

Selkirk has been recommended by me as the point at which Red River can most advantageously be bridged. This point of crossing has been recommended with the view of avoiding all contingency of interruption to traffic by inundations, and the possible cost of reconstruction of works swept away by floods and for other reasons which I have set forth.

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* *Vide* Appendix No. 15, page 246, Reports on location of 2nd 100 miles section west of Red River.

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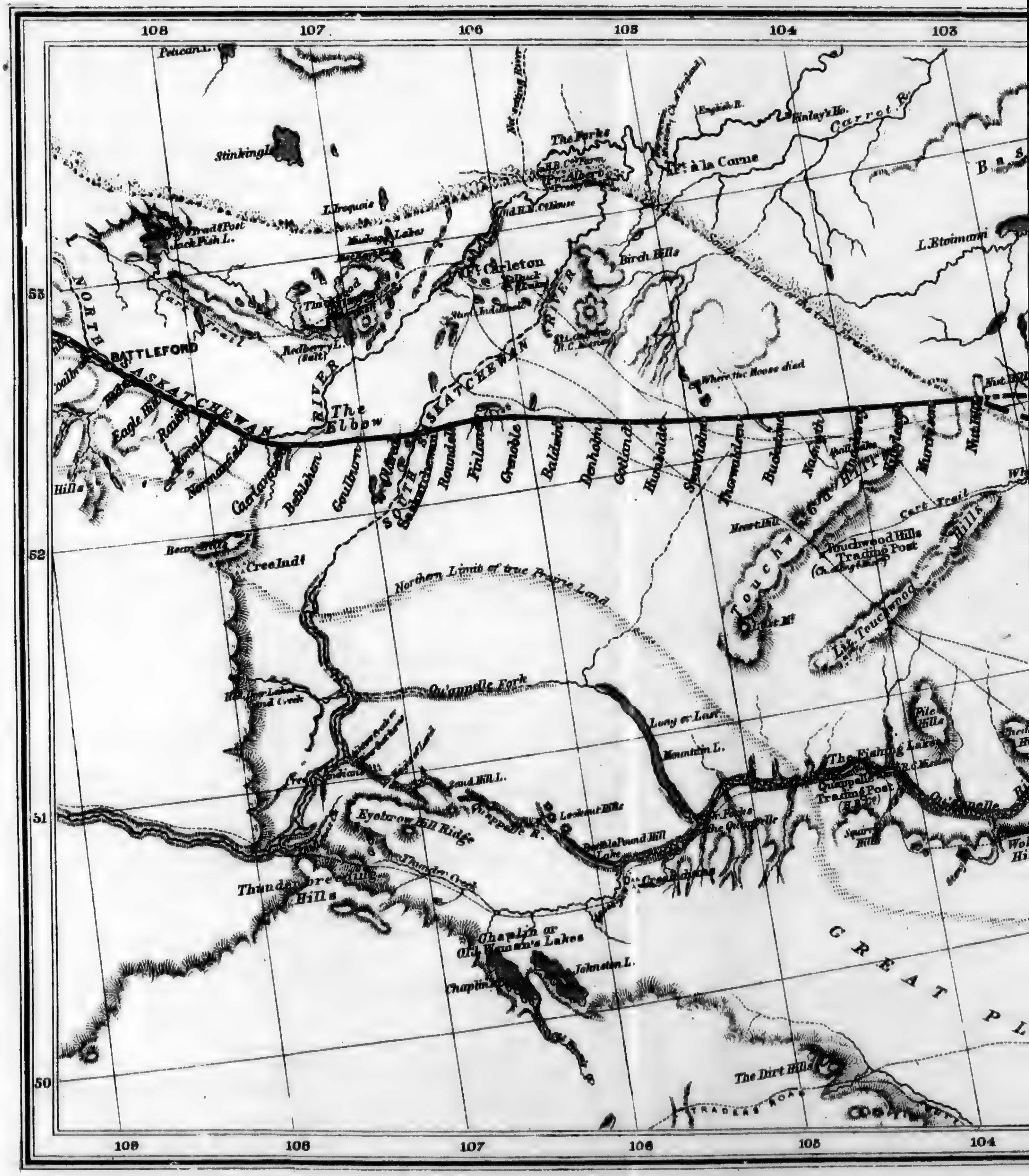
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Pelican L.
Stinking L.
L. Iroquois
Jack Fish L.
Muskeg Lakes
Thickwood Hills
Redberry L. (Salt)
NORTH SASKATCHEWAN
BATTLEFORD
Cart Trail
Eagle Hill
The Elbow
RIVER
Ft. Carleton
Duck Lake
Old H.B. Co. House
The Forks
H.B. Co. Farm
Pr. Albert
Ft. à la Corne
English R.
Finlay's Ho.
Carrot R.
Birch Hills
Southern Limit of the true Forest
Where the Moose died
L. Etoimami
SOUTH SASKATCHEWAN
Battleford
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Normanfield
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Bethlehen
Goulburn
Roundel
Finlona
Grenoble
Baldwin
Denholm
Gotland
Humboldt
Swanholm
Thornhilden
Buckingham
Nasmyth
Nutting
Murdoch
Touchwood Hills
Touchwood Hills Trading Post
Cart Trail
Lit. Touchwood
Heart Hill
Northern Limit of true Prairie Land
Cree Indt
Qu'appelle Fork
Long or Last
Sand Hill L.
Lookout Hills
Eyebrow Hill Ridge
Qu'appelle R.
Thunder Creek
Thunder breeding Hills
Chaplin or Old Woman's Lakes
Johnston L.
Cree Indians
The Fishing Lakes
Qu'appelle Trading Post (H.B.Co.)
Pile Hills
Squirrel Hills
Qu'appelle
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The Dirt Hills
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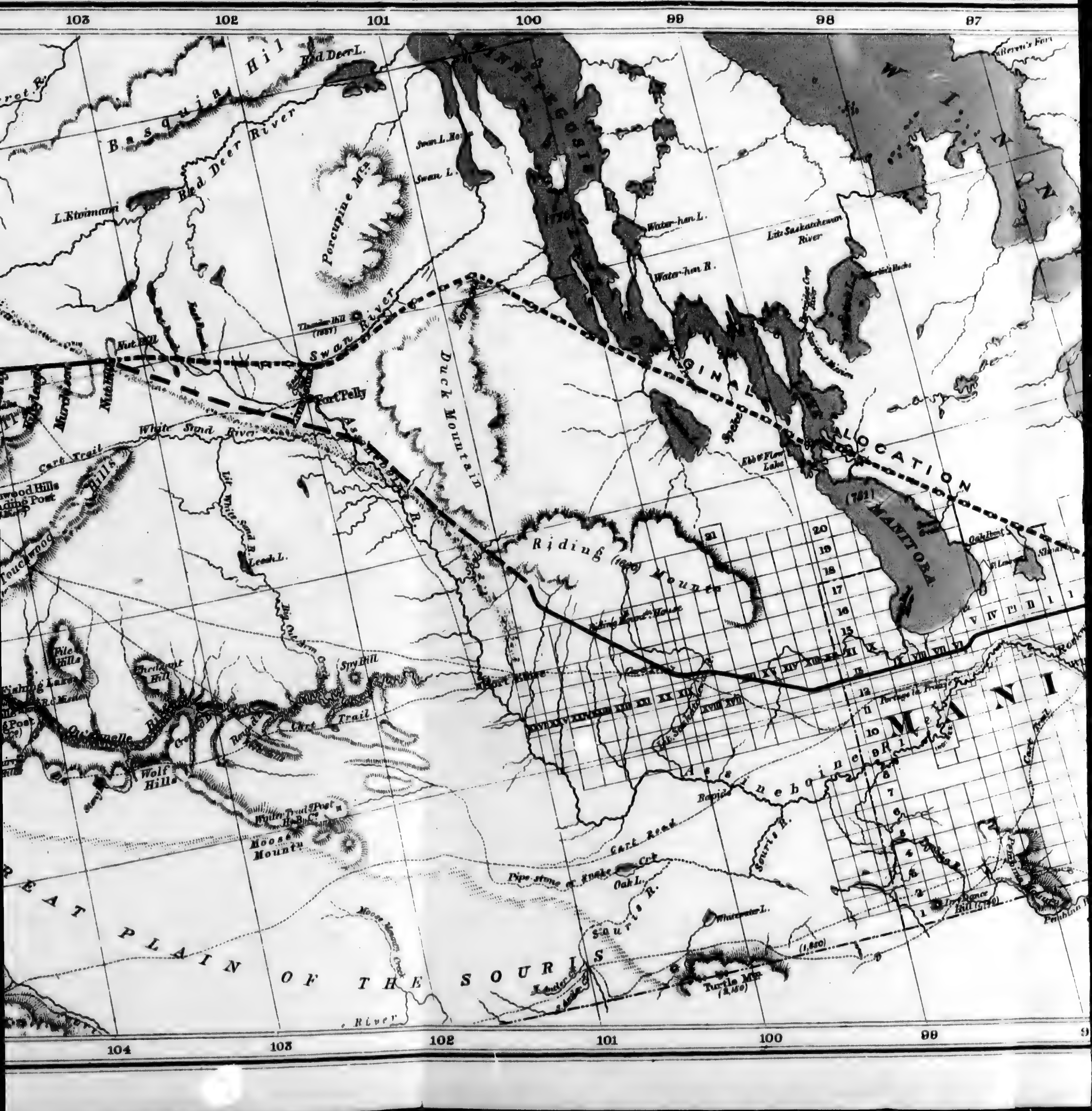
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Red Deer L.
Red Deer River
L. Etoimami
Porcupine Mts
Swan L. Ho.
Swan L.
Thunder Hill (1687)
Swan River
Nut Hill
Fort Pelly
Duck Mountain
White Sand River
Cart Trail
Hills
wood Hills
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Touchwood
Lit. White Sand R.
Leech L.
Assiniboine R.
Water-hen L.
Water-hen R.
Lit. Saskatchewan River
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ORIGINAL LOCATION
Spike
Ebb & Flow Lake
(781)
MANITOBA
Oak Point
St. Laurent
Riding Mount
Riding Mount. House
Pile Hills
Fishing Lakes
Qu'Appelle
Wolf Hills
Spy Hill
Trail
Fort Ellice
Cart Trail
Moose Mount.
Cart Road
Pipe stone or Snake Crk
Oak L.
Souris R.
Moose Mount. Creek
River
GREAT PLAIN OF THE SOURIS
Whitewater L.
Turtle Mt. (2,150)
(1,850)
Assiniboine R.
Rapids
Portage la Prairie
M A N I
Cart Road
Pembina
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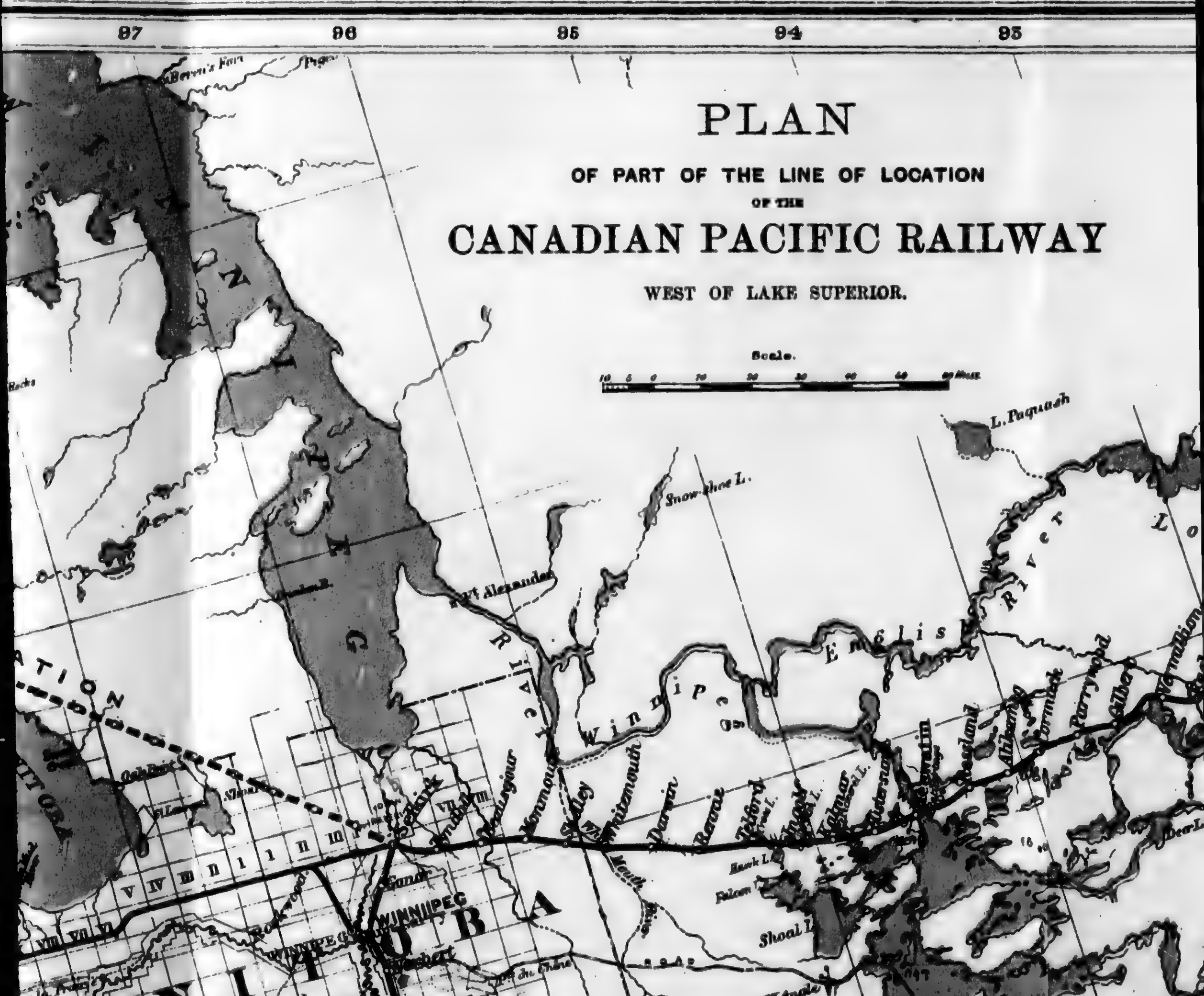


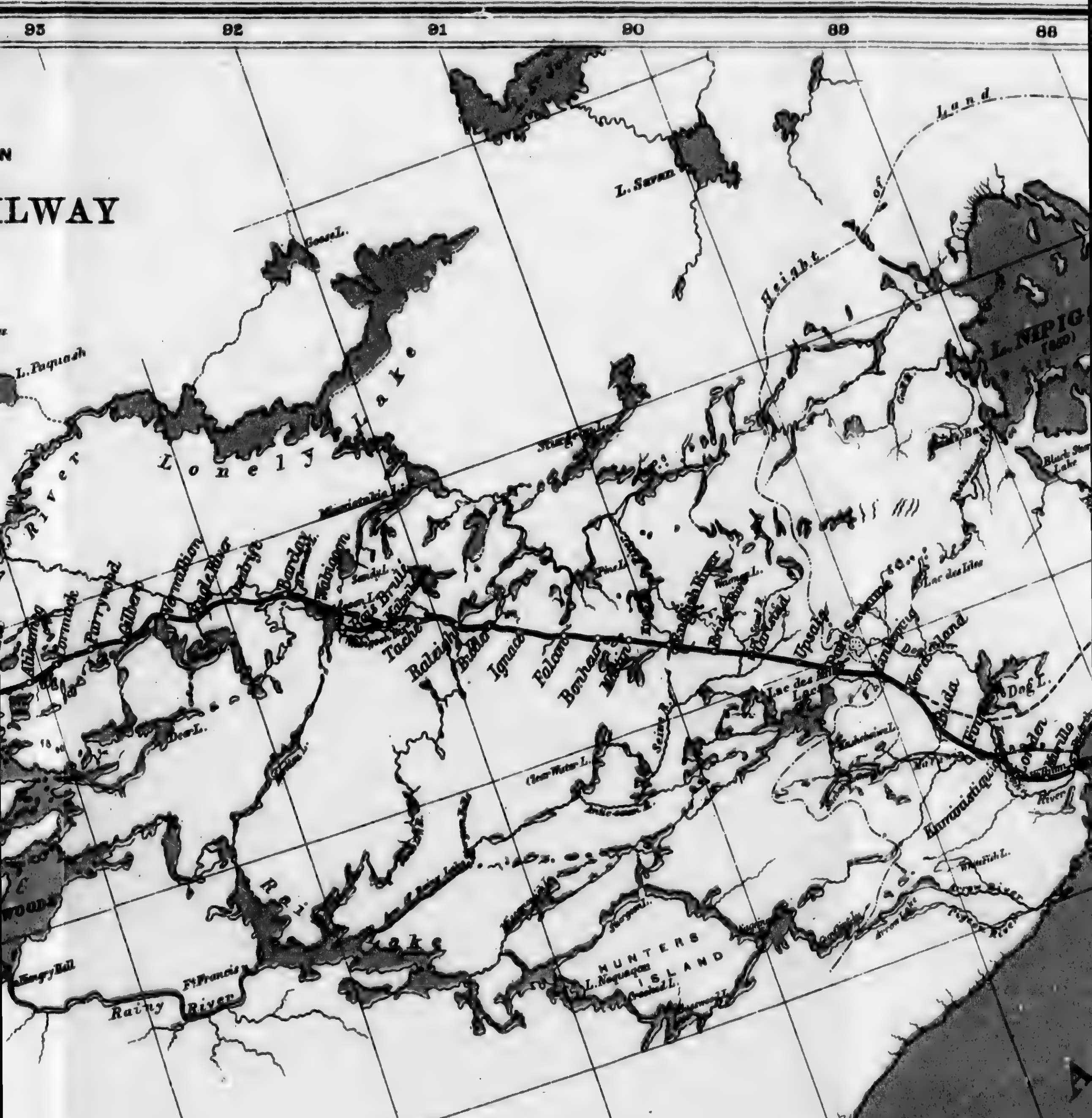
# PLAN

OF PART OF THE LINE OF LOCATION

OF THE

# CANADIAN PACIFIC RAILWAY

WEST OF LAKE SUPERIOR.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L. Paquash
L. Seven
Goose L.
Height of Land
Lonely Lake
River
Manitoba L.
Alborne
Cormick
Parrywood
Gilbert
Vermillion
Eagle River
Dinorwic
Barclay
Wabigoon
Sandy L.
Bruli
Tache
Raleigh
Ignace
Falcon
Bonheur
Pine L.
Wagonga L.
Upsala
Lac des Mille Lacs
Lac des Iles
Savanne
Nordland
Dog L.
Black Sturgeon Lake
L. NIPIGON
(850)
Deer L.
Clear Water L.
Seine R.
Rainy Lake
Kaministiquia
Whitefish L.
Pigeon River
River
HUNTERS ISLAND
L. Namaqan
Crooked L.
WOODS
Hungry Hall
Ft. Francis
Rainy River
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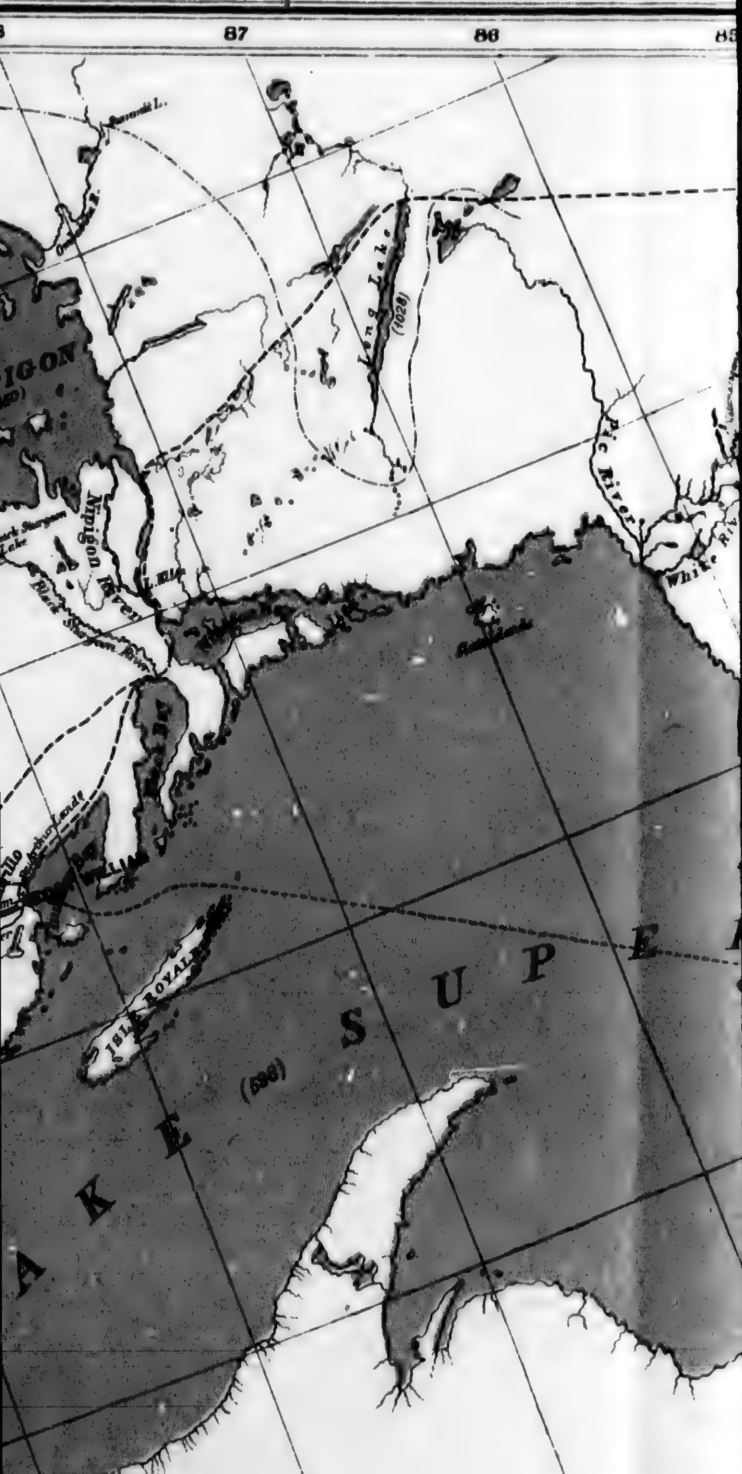
**Plate No. 4.** *To accom*



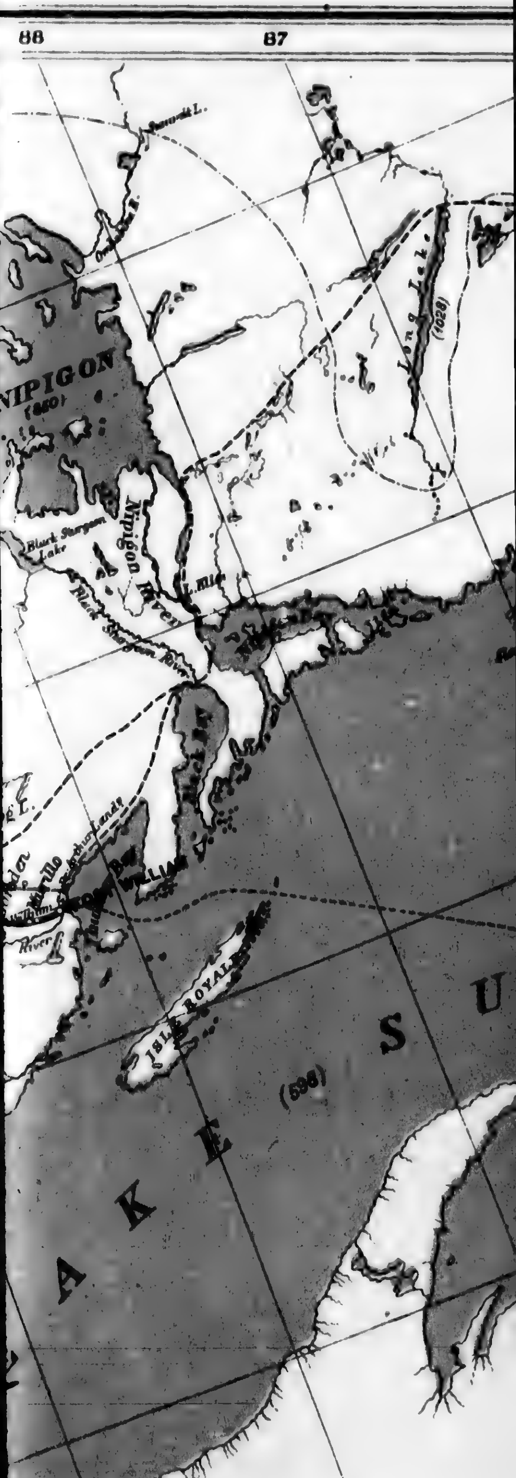
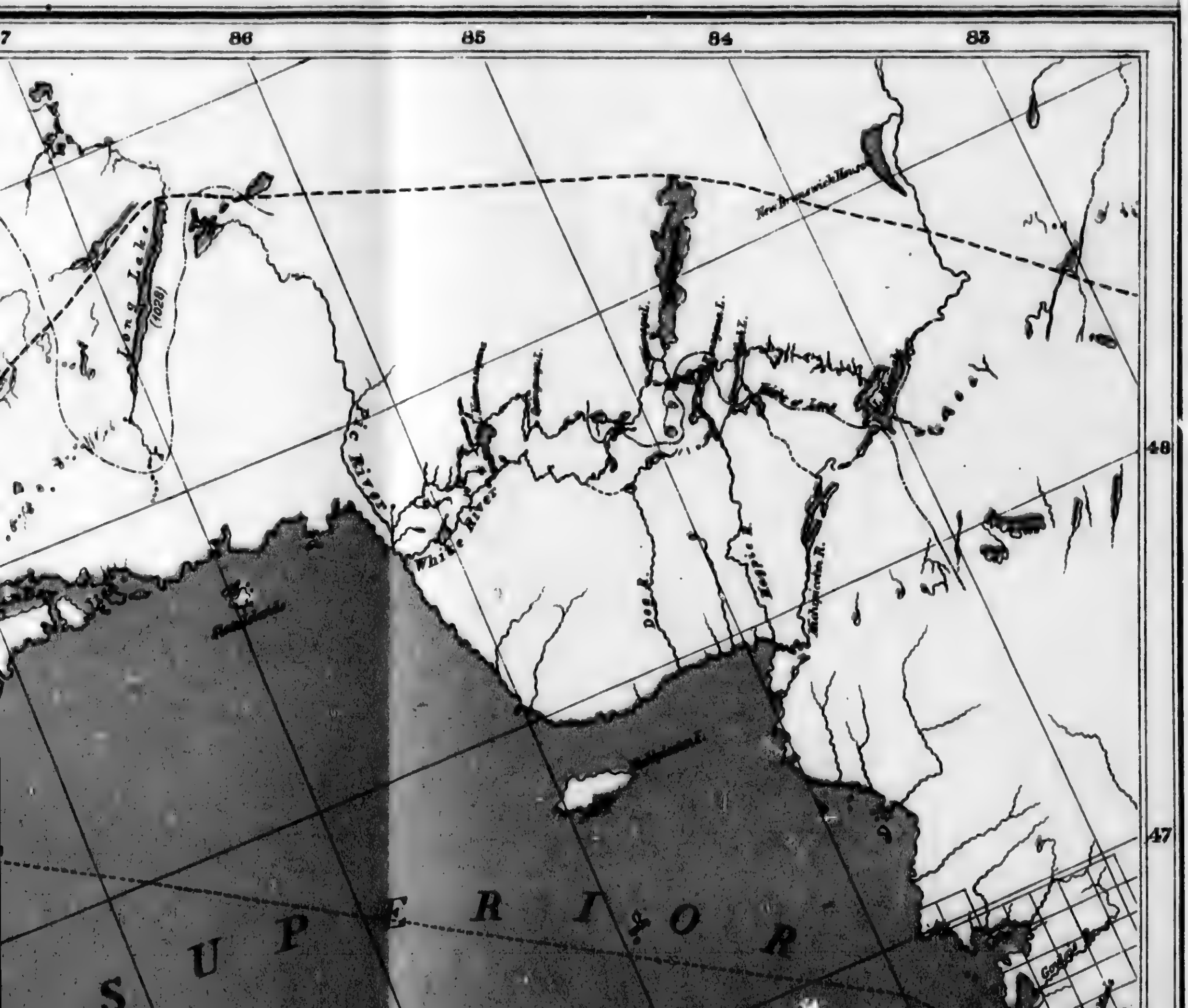


**Plate No. 4.** *To accompany Report of the Engineer-in-Chief, Canadian Pacific Railway, 1880.*



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The subject is fully discussed in my report of 8th December, 1879, which, with other documents on the same subject, is appended.* The question being still under consideration by the Government, the Corporation of Winnipeg have determined to construct a bridge opposite that city at their own cost, assuming all risk and responsibility in connection with the structure.

General conditions have been laid down by the Government which may be held to apply to the construction of a bridge across the Red River at any point north of the International boundary line, as follows :—

1st. That the site of the bridge shall be at a straight part of the river, and not near a bend.

2nd. That the free flow of the river at all times shall be interfered with as little as possible.

3rd. That any obstruction to the flow of the water caused by piers, shall be compensated as far as practicable by increasing the water-way.

4th. That the underside of the bridge shall be higher than the highest known flood level.

5th. That the navigation of the river shall not be obstructed.

### SURVEYS AND EXPLORATIONS IN THE WOODLAND REGION.

Surveys have been continued to establish the most desirable location for the subsidized section of the Canada Central Railway. The necessity for determining the point at Lake Nipissing, at which connection with the main line can be advantageously made, became more urgent as the work advanced.

The Canada Central Extension commences at Pembroke, where it connects with the present railway system. The line runs parallel to the River Ottawa, at no great distance from it, until it gains the village of Mattawa, thence it follows a westerly course until it reaches Lake Nipissing.

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* *Vide* Appendix No. 16, page 264, Documents in reference to the bridging of Red River.

The information previously obtained pointed to South-East Bay, as the most desirable terminal point on Lake Nipissing, and all surveys have since been undertaken on the assumption that South-East Bay would form the point of connection between the railway and navigation. The Canada Central Railway Surveys have been directed to this point.

A preliminary location survey has been made from South-East Bay, north-westerly, along Lake Nipissing, to a point on Sturgeon River, about 60 miles distant.

Surveys have been made of French River, with the view of rendering it navigable by the construction of locks and dams and a line of canal where required. It was at one time thought that the formation of a canal by way of French River would be preferable for the purpose of reaching Lake Huron to the construction of the Georgian Bay Branch. A report on the survey is appended.*

Explorations have been made in the direction of Sault St. Mary, on a route north of Lake Nipissing. These examinations have been undertaken in order to ascertain if the main line of the railway can be so located as to admit of a connection being satisfactorily made with Sault St. Mary without unduly prolonging either the length of the main or the connecting line, on ground favorable for construction; in other words, to establish whether it be possible for the two lines to run over a common route for any great distance. Reports on these examinations will be found appended.†

The examination has established that a common location north of Lake Nipissing can be followed from near South-East Bay for 60 or 70 miles, and that a favorable route can be obtained for a branch to the outlet of Lake Superior.

The project of connecting the railway system of the Dominion by a branch line with Lake Superior, will extend desirable facilities to traffic, and must exercise an important influence on the settlement of the North-West country. Such a scheme will admit of the construction of steamers of large draught to navigate Lake Superior, the use of which will greatly reduce the cost of transit for freight and passengers.

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* *Vide* Appendix No. 17, page 286, Report on a survey of French River, by Mr. E. P. Bender.

*Vide* Appendix No. 18, page 290, Reports on examinations north and west of Lake Nipissing, by Messrs. Austin, Brunel and Murdoch.

The present depth of water available for navigation from ports on the lower lakes is limited. The River St. Mary and the shallow waters of Lake St. Clair present a bar to any craft of deep draught. Vessels which would be confined to the navigation of Lake Superior may be built of any draught and size that cheap transportation may dictate.

On the completion of the line from Fort William to Selkirk, a railway from the east to Sault St. Mary, to connect with commodious steamers on Lake Superior, would greatly facilitate the introduction of settlers to the North-West. During the season of navigation, this line would offer great advantages. It would be the most direct route; it would be subject to no delays and inconveniences from Customs regulations; and it would provide more efficient means of rapid and cheap transit than could be obtained elsewhere.

We have not yet sufficient data to speak of the period of the opening and closing of navigation on Lake Superior, nor of the extent to which that lake may be navigated during the winter months. It is not improbable that owing to its deep and open water, the season of navigation may be prolonged to a later date than on the rivers and canals which connect the lower lakes.

There is ground for the belief that the construction of a line to the navigable waters of the eastern end of Lake Superior, would attract traffic from Duluth and the new harbors which are rising up around the United States shore of the lake. Even now grain is brought by Canadian steamers from Duluth. With enlarged capacity for carrying, and facilities for rapid discharge and speedy transit to tide-water, the Sault St. Mary line would be able to compete with more southern routes, and thus in an important degree promote the interests of the lower St. Lawrence navigation. Cars loaded at Lake Superior would follow a course direct to Montreal and Quebec.

The facilities for bridging the River St. Mary will doubtless soon lead to the establishment of railway connections extending through the northern part of Michigan and through Wisconsin to Minnesota. Already the railways of the United States south of Lake Superior extend to Escanaba, a point not more than 150 miles from Sault St. Mary. It appears also, from late information, that a line is under contract and in process of construction easterly to the Strait of Mackinaw. This line will reach within forty miles of Sault St. Mary. A railway on this short distance, with the Sault St. Mary branch, would connect the railway systems of the North-Western States with Eastern Canada. All the country north and west of Green Bay and St. Paul would have a choice of outlets. The Canadian outlet would be more direct than any route *via* Chicago and the south shore of Lake Michigan, it would consequently command the traffic at all seasons of the year from every point north of the latitude of St. Paul.

Surveys have been continued east of Thunder Bay to Nepigon Bay, and thence easterly *via* the north end of Long Lake. The examinations have been continued during the winter. Full returns have not, at this date, been received, but so far as ascertained the surveys have established that a line, of a moderately favorable character, can be obtained.

### CONSTRUCTION.

The first expenditure on construction was towards the end of 1874. Contracts were then entered into for the telegraph from Lake Superior to British Columbia along the route of the railway, including the clearing of the forest land to a width of 132 feet. The line was divided into four sections, on three of which the work was prosecuted with vigor, and the telegraph completed from Fort William to Edmonton, 1,200 miles, so that messages could be transmitted. The remaining section across the mountains to British Columbia remains incomplete.

In the same year 1874, the grading of the Pembina Branch for 63 miles north of the International Boundary was commenced. In 1877, the grading was extended to Selkirk under the same contract, and in 1878, the track was laid on the whole length 85 miles.

In 1874, the extension of the Canada Central Railway to the eastern terminus near Lake Nipissing was subsidized.

Towards the end of 1874, 50,000 tons of steel rails with the necessary fastenings were purchased, 11,000 tons of which were subsequently transferred to the Intercolonial Railway.

Early in 1875 two sections were placed under contract. No. 13 extending west of Fort William, the work terminating at Sunshine Creek 33 miles distant; and No. 14

from Selkirk east to Cross Lake, 76 miles. These contracts embraced grading, culverts and bridging.

An extension east of Cross Lake 36 miles to Keewatin, at the outlet of Lake of the Woods, was placed under contract in January, 1877. This contract (No. 15) included the grading on Section 15, and the track-laying and ballasting on Sections 14 and 15, in all 112 miles east of Selkirk.

In 1876 a contract (No. 25) was made for an extension from Sunshine Creek west to English River, (80 miles) embracing the grading and bridging for that distance, together with track-laying and ballasting on Section 13. The whole distance from Fort William to English River being 113 miles.

In 1878 the Georgian Bay Branch was undertaken. This work was subsequently abandoned.

The engine house at Fort William was contracted for in 1876; that at Selkirk in 1878.

In the Spring of 1879 the line between English River and Keewatin, 185 miles was let in two Contracts, Nos. 41 and 42, for grading, bridging and track-laying.

In the summer of 1879, a section of 100 miles west of Red River, including a branch from the main line to the City of Winnipeg was placed under contract.

An additional supply of 39,000 tons of steel rails and fastenings was secured in 1879.

The grading, bridging, track-laying and ballasting in British Columbia, from near Yale to Savona's Ferry, a distance of about 127 miles, were placed under contract towards the close of 1879.

The length of line now under contract consists of the following sections:

| | | |
|---|---|---|
| Fort William to Selkirk, (main line) | 410 | miles.* |
| Selkirk to Emerson, (Pembina branch) | 85 | " |
| West of Red River (main line and Winnipeg branch) | 100 | " |
| In British Columbia, (main line) | 127 | " |
| Total under construction | 722 | " |

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* The location is being amended on Section 41, by which it is expected the distance will be reduced from 3 to 4 miles.

Tenders are now invited for a second 100 miles section west of Red River. This will make a total length of 822 miles under construction, consisting of main line 720 miles, Pembina and Winnipeg branches 102 miles.

The rails are laid 136 miles west of Fort William, and 90 miles east of Selkirk. Traffic trains are regularly run from Emerson to Cross Lake, 161 miles.

The importance of securing cheap transportation between the Prairie Region and the eastern markets has been kept prominently in view in establishing the railway between Selkirk and Lake Superior. I have in previous reports described the efforts made from the beginning of the survey to attain this object.†

In my report of last year (p. 18), I referred at some length to the subject, and drew attention to the fact that the Government had placed under contract the whole distance east of Red River on a location definitely established with gradients so light and favorable that cheap transportation is assured for all time to come.

This important condition is not attained without difficulty. At some points it has involved heavier works than would have been rendered necessary had steeper gradients been employed; but these points are remarkably few, and the increased expenditure, compared with that of the whole line is small. The advantage gained will amply compensate for the extra expenditure incurred; and the results to be attained can be easily understood by reference to the Report on Rolling Stock appended.* It can there be seen that the same engine which would transport 19 cars with a paying load of 190 tons, over a line with the ordinary gradients, would take 37 cars with 370 tons load over the Pacific Railway with the gradients obtained. Moreover, it is calculated that the "consolidation" class of locomotives proposed to be brought into use ultimately, will be capable of hauling, from Manitoba towards Lake Superior, on the gradients established, as much as 765 tons of paying load.

Low gradients are not considered of equal importance on other sections of the line. It is not proposed to adhere to the principle in British Columbia. The grades and curves will be there determined by the physical obstructions which present themselves. The limitation observed will take a much wider range, in order to avoid expenditure, and it is proposed, as far as practicable, to lighten the work by accommodating the alignment and gradients, as far as this can be done, to the features of the ground.

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† *Vide* Reports 1874, 1877 and 1879.

* *Vide* Appendix No. 19, page 307, Report on the standard locomotive to be adopted, by Mr. Charles Blackwell.

### ROLLING STOCK.

In providing the rolling stock for railways, a point of great importance has not always been sufficiently observed on the lines in Canada and the United States. I refer to the construction of locomotives and rolling stock generally, according to specific, well-chosen standards. The locomotives on the same line are commonly of different types and their parts of various patterns. This is due to the fact that each individual maker is generally allowed to supply locomotives according to his own designs—a practice in every respect disadvantageous, and the effect of which is to add to the difficulty in making repairs and consequently to increase the working expenses.

It early appeared to me important to endeavor by every available means to avoid the inconvenience and expense attendant on the working of a miscellaneous collection of locomotives and other rolling stock for the Pacific Railway, and to aim at having engines and cars of the best design, uniform in detail as well as in general character. It was felt, that, although this might involve the exercise of care and judgment in selecting the best types, in preparing the plans and working drawings, and in furnishing guages and tem-plates of all the working parts to different manufacturers, in order to secure uniformity, the object was in all respects well worth the effort.

Steps have accordingly been taken to determine the best standard for the rolling stock. It is important to have but one, or at most two, types of locomotive, so that the parts may be of a constant pattern and inter-changeable. With other kinds of rolling stock, as with locomotives, it is desirable to have as little variation of details as practicable, so that in the event ot injury, the damaged portions may readily be replaced from the general store, with as little labor in fitting as possible.

Acting under the authority given me, Mr. Charles Blackwell was instructed to visit the several locomotive and car establishments and the railway workshops in Canada and the United States, and to report on the character of rolling stock best adapted for this work.

The experience of Mr. Tandy, Inspector of rolling stock on the Intercolonial Railway, was also enlisted.

Their reports are appended.* Plans and specifications, and working drawings of the standard locomotive, and the different classes of cars are in course of preparation.

Tenders will be received on the 1st of July for the rolling stock which will be required during the next four years.

### GENERAL SERVICES.

The following services also call for consideration at an early period :

1. Watering stations at frequent intervals along the line.
2. Additional engine-houses to be at points from 100 to 150 miles apart, to meet the exigencies of traffic.
3. Machine and repair shops.
4. Elevators and grain stores at the terminus on Lake Superior.
5. Subsidiary station elevators for collecting grain, as necessity may determine.
6. Station-houses and auxiliary buildings.

All these works, on a defined and sufficient basis, are indispensable to the successful working of the line, and to the accommodation of public traffic. With these results in view their provision cannot be long delayed.

### CONTRACTS.

At the date of my report of last year (5th April), the several contracts were 42 in number; since then 25 additional contracts have been entered into, viz. :—

Contract No. 43.—For Equipping and working the Pembina Branch.
" " 44 Supply of 2,000 tons steel rails and fish-plates.
" " 45 " 1,500 " "
" " 46 " 1,500 " "
" " 47 " bolts and nuts.

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* *Vide* Appendix No. 19, page 310, Report on the standard passenger and freight engines proposed for the C. P. R., by Messrs. Blackwell and Tandy.

| | | |
|---|---|---|
| Contract No. | 48.—For | Grading and track-laying, first 100 miles section, west of Red River. |
| " | " 49 | Erection of station buildings, Pembina Branch. |
| " | " 50 | Supply of 700 tons of spikes. |
| " | " 51 | " 35 tons of bolts and nuts. |
| " | " 52 | Transportation of 4,000 tons of rails and fastenings to Fort William. |
| " | " 53<br>" 54<br>" 55 | Supply of 34,000 tons of steel rails and fastenings. |
| " | " 56 | An iron bridge for the Pembina Branch. |
| " | " 57 | Supply of railway switch-frogs and switch-gearing. |
| " | " 58 | Furnishing and erecting Turn-tables. |
| " | " 59 | " 100,000 ties for second 100 miles section west of Red River. |
| " | " 60 | Grading and bridging, from near Yale to Boston Bar. |
| " | " 61 | " " Boston Bar to Lytton. |
| " | " 62 | " " Lytton to Junction Flat. |
| " | " 63 | " " Junction Flat to Savona's Ferry. |
| " | " 64 | Temporary bridge over Red River, at Winnipeg. |
| " | " 65 | Four first-class cars and one official car. |
| " | " 66 | Grading and track-laying, second 100 miles section, west of Red River. |
| " | " 67 | Sixty box freight cars and sixty platform freight cars. |

A description of these several contracts, with prices, conditions and other information is appended.*

All the contracts entered into for grading, bridging, track-laying, etc., since the beginning of 1879, have special provisions for guarding the public interests, empowering the Government, under certain contingencies, to take the work out of the contractor's hands, and likewise to prevent any expenditure over a specific sum.

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*Vide Appendix No. 20, page 311, Description of contracts entered into since the beginning of 1879. Contract No. 66 for the 2nd 100 miles section west of Red River, executed before going to press, is also included.

These special conditions are embraced in the contracts for the following sections, viz.:—

| | | | |
|---|---|---|---|
| Section No. 41. | English River to Eagle River | 118 | miles. |
| “ 42. | Eagle River to Keewatin | 67 | “ |
| “ 48. | First 100 miles West of Red River | 100 | “ |
| “ 60. | Emory's Bar to Boston Bar | 29 | “ |
| “ 61. | Boston Bar to Lytton | 29 | “ |
| “ 62. | Lytton to Junction Flat | 28½ | “ |
| “ 63. | Junction Flat to Lake Kamloops | 40½ | “ |
| “ 66. | Second 100 miles West of Red River | 100 | “ |

These sections, in all 512 miles, are to be constructed under the same form of contract, a copy of which is appended.*

A schedule of all the contracts entered into, with the amounts paid in each case, together with the probable expenditure involved, is appended.† The total amount expended under the several contracts to 31st December, 1879, is $9,486,565.03.

An estimate of the cost of opening the whole line to the Pacific Coast, is also appended.‡

### THE PACIFIC RAILWAY TELEGRAPH.

I have referred, in previous reports, to the condition of the line of telegraph to connect the Provinces on the Atlantic and Pacific coasts. With the exception of the contract for the section between Edmonton and Cache Creek, in British Columbia, which has been cancelled owing to the unsatisfactory progress made by the contractor, the line generally speaking is in the condition which I described a year ago.

The telegraph has become a necessity in the working of railways, and when, eventually, the Pacific Railway shall have been constructed, the addition of the telegraph would follow as a matter of course. But, under the circumstances which obtain in the present instance, it appears to me essential that the construction of the telegraph should precede the railway. From the vast distances which intervene between the seat of Government and the points where railway expenditure is to be made, the telegraph may be viewed as one of the main auxiliaries in controlling the outlay. Even under this one aspect, apart from the other benefits which it would confer, the completion of the telegraph should not, in my judgment, be long postponed.

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* *Vide* Appendix No. 21, page 328, Form of contract for grading, etc.

† *Vide* Appendix No. 22, page 350, Summary of payments made on all contracts, etc.

‡ *Vide* Appendix No. 23, page 353, Documents referring to the cost of opening the railway from the eastern Provinces of the Dominion to the Pacific Coast.

The construction of the railway in British Columbia, some of the heaviest sections of which are now under contract, and the many questions which will constantly arise during the progress of the work, will make frequent telegraphic communication between the Pacific coast and Ottawa a necessity. The non-completion of the telegraph in Canadian territory, will, therefore, cause inconvenience and serious expense. All telegrams will have to be sent by California. Foreign companies will reap the benefit of the traffic, while the portion of our own line in operation to Edmonton will remain for the most part unemployed and unremunerative, as the merely local traffic is limited and insufficient to meet the expenses of operating and maintenance. There are, therefore, strong reasons for the connection of the telegraph at Edmonton with the system in operation in British Columbia. In its present incomplete condition, the capital so far expended in its construction remains unproductive, and brings no proportionate benefit. Developed and placed upon a proper basis the line would be of great public service. With the connections to which I shall presently refer, I believe that it would ultimately become highly remunerative.

I have discussed in former reports the different modes of establishing telegraphic communication between Fort William, Lake Superior and the seat of Government.

One method is to submerge, north of the Counties of Grey and Bruce, cables across Lakes Superior and Huron to Tobermoray in the Indian Peninsula, with intermediate land lines across the peninsula at Sault St. Mary, and over Manitoulin Island; a land connection from Tobermoray being made with Southampton or Owen Sound.

Another plan is to establish the line for the railway from the north side of Lake Superior to Lake Nipissing, and to construct a land telegraph on that line, making a connection at Lake Nipissing, by the extended Canada Central Railway from Ottawa.

Another means of obtaining continuous telegraphic communication, without passing through a foreign country, is afforded in connection with the projected railway to Sault St. Mary. The telegraph may be carried along the route of this railway to the eastern end of Lake Superior, with a submerged line across the lake to the telegraph at Thunder Bay.

In my report of last year, I submitted for consideration two modes by which the Pacific telegraph line might be completed and rendered useful:—

1. To complete it as a Government work, and operate it directly under a Department, as in Great Britain, France and other countries with uniform low scales of charges.

2. To transfer the 1,200 miles constructed to some company which would undertake to complete and operate the whole line on conditions to be determined.

If it be deemed expedient that the Government should be relieved of the work, there would possibly be but little difficulty in organizing a company which would assume the task of completing the desired connection on terms acceptable to the public

### *Sub-Marine Extension to Asia.*

The telegraph completed and in operation from ocean to ocean, opens up a prospect of extended usefulness, and promises advantages which do not alone concern Canada.

A map of the World, setting forth the great telegraph lines in operation, shows that Canada is situated midway between the masses of population in Europe and Asia, and establishes the peculiarly important geographical position which the Canadian Pacific telegraph line will occupy.

Seven submarine cables have been laid across the Atlantic, of which two are not now in working order. Of the remainder, three are landed on the shores of Canada. One, after first touching the French Island, St. Pierre Miquelon, is carried to the United States. The fifth line in use extends from Portugal *vid* Maderia, and St. Vincent to Brazil.

Europe is connected with Asia by four main telegraph lines. One by way of Portugal, Spain, Malta, Egypt and the Red Sea. A second passing through France, Italy and Greece, also follows the Red Sea. A third traverses Germany, Austria, Turkey and Persia. A fourth passes through Russia, and follows the River Amoor to the Sea of Okhotsk. The two first touch at Aden, at the entrance to the Red Sea, from which point a submarine line extends to Zanzibar, Natal and the Cape Colonies. From Aden the main lines are extended to India. From India two separate lines have been carried to Singapore. From Singapore connections are established north-easterly to Hong Kong and Japan, and south-easterly to Australia and New Zealand.

The rapidity with which the telegraph cables across the Atlantic have been multiplied, and the construction of more than 400,000 miles of land and submarine telegraphs over the globe, afford evidence of the work which they are called upon to perform. The few years in which these results have been attained, indicate the rapidly growing magnitude of telegraphic traffic, and circumstances conclusively point to a demand for vastly increased facilities of communication between the great centres of population and commerce of the world.

While, on the one hand, the telegraph has extended easterly across Europe and Asia, and, on the other hand, westerly across the Atlantic, the Pacific Ocean remains untraversed. The explanation may lie to a great extent in the fact that the character of the bed of a great part of the ocean forbids the attempt. In more southern latitudes, the great central area of the Pacific Ocean is marked by sub-aqueous rocky ledges and coral reefs, the existence of which has deterred any telegraphic enterprise from being carried out. Submarine cables have at different times been projected to cross the Pacific, one of which was to have started from San Francisco, to touch at the Sandwich Islands; but on account of the broken and unsuitable character of the ocean-bed, the project after considerable expense had been incurred was eventually abandoned.

The chart of the United States surveys of the northern part of the Pacific Ocean (1877), shows that a line from the north end of Vancouver Island to the Aleutian Islands, and from the Aleutian Islands to Japan *viâ* the Kurile Islands, has a depth averaging from 2,000 to 2,500 fathoms, and the soundings reveal a soft, oozy bottom, presenting similar conditions to the north Atlantic Ocean, on the plateau of which cables have been successfully laid.

From her geographical position, Canada has unusual facilities for taking advantage of these favourable conditions, and the belief is warranted that when a submarine telegraph is laid from America to Asia, its location will naturally be in connection with the Canadian overland telegraph to the Pacific coast.

The cable may start from one of the deep-water inlets at the north end of Vancouver Island, and be sunk in a direct course to Japan, or it may touch about midway, Amlia, one of the Aleutian Islands. At Yezo, in Japan, the connection would be made with the Asiatic telegraphs. As an alternative route the submarine line may land on one of the Kurile Islands, north of Japan, and thence extend direct to Hong Kong. Either course would complete the connection with the whole eastern telegraph system, and effect important results.

1. It would connect San Francisco, Chicago, Toronto, New York, Montreal, Boston, and all the great business centres of America with China, and the principal ports of Asia, much more directly than by the present lines of telegraph by way of Europe.

2. It would open a new means of communication between America and Asia, to be employed for purposes of general commerce at much lower rates than by existing channels.

3. It would obviate the objection to lines which pass through countries where different languages are spoken, a circumstance which often causes error in the transmission of messages. The new line would be employed for the most part by the English-speaking people of both hemispheres, and consequently one language only need be used by the telegraph operators. Thus a fruitful source of mistakes would be avoided and the charges for transmission would be freed from all incidental additions, and reduced to the lowest remunerative rates.

4. It would complete the telegraphic circuit of the globe, and would be available for highly important scientific investigations.

5. It would bring Great Britain, Canada, India, Australia, New Zealand, South Africa, indeed all the outer Provinces and the colonial possessions of Great Britain in unbroken telegraphic communication with each other, in entire independence of the lines which pass through foreign European countries.

6. It could scarcely fail to prove of very great advantage for purposes of State as the line might be so established as to remain under Government control, to be immediately serviceable on any emergency.

I append correspondence in which the importance, practicability, cost and remunerative prospects of the Canadian Pacific telegraph extended to Asia are considered.*

I respectfully submit that, whatever arrangements may ultimately be made for carrying out the undertaking, it is obvious that much of the advantages, political and commercial, which undoubtedly must result, will accrue to Canada.

I have the honor to be, Sir,
Your obedient servant,
SANDFORD FLEMING,
*Engineer-in-Chief.*

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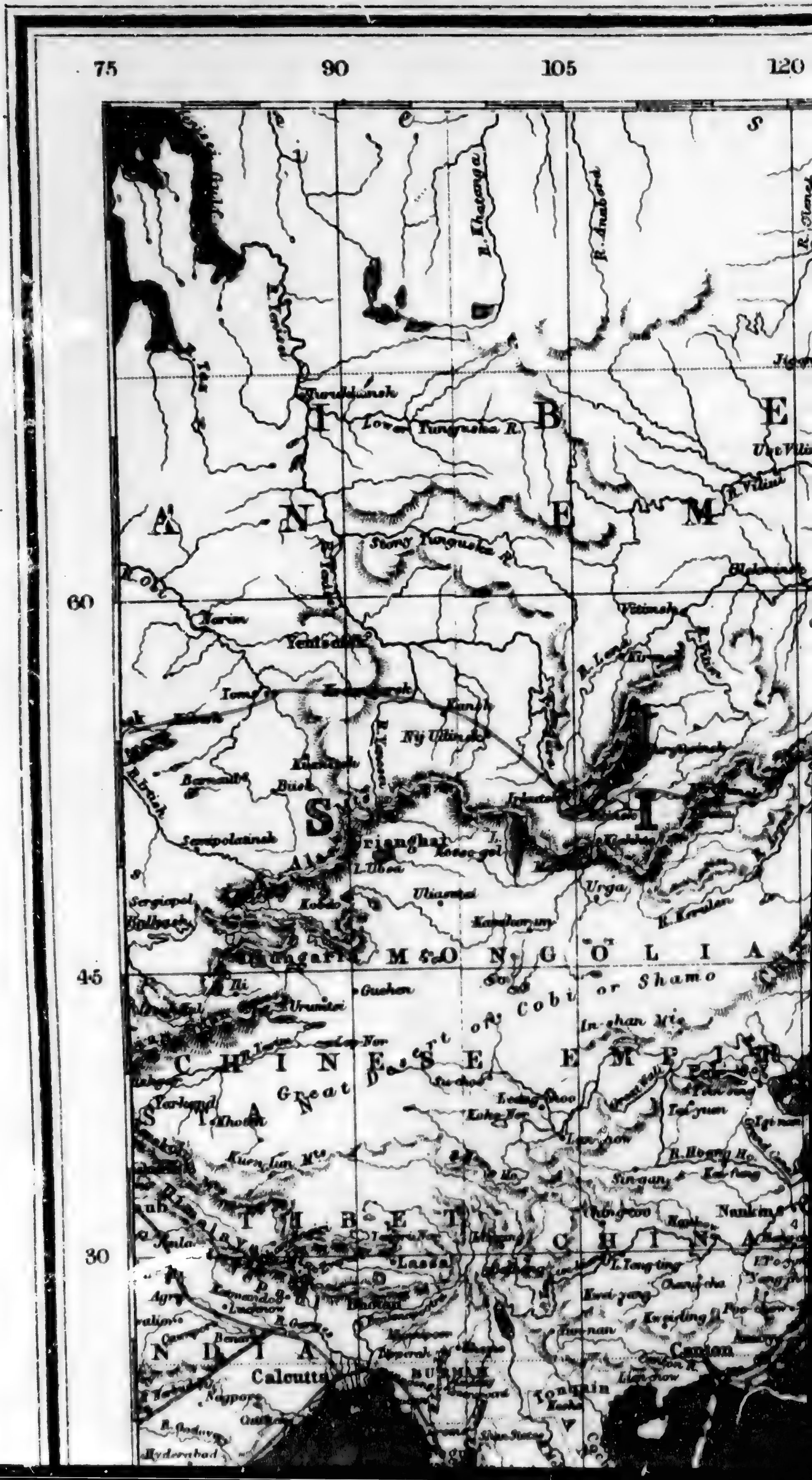
* *Vide* Appendix No. 24, page 357.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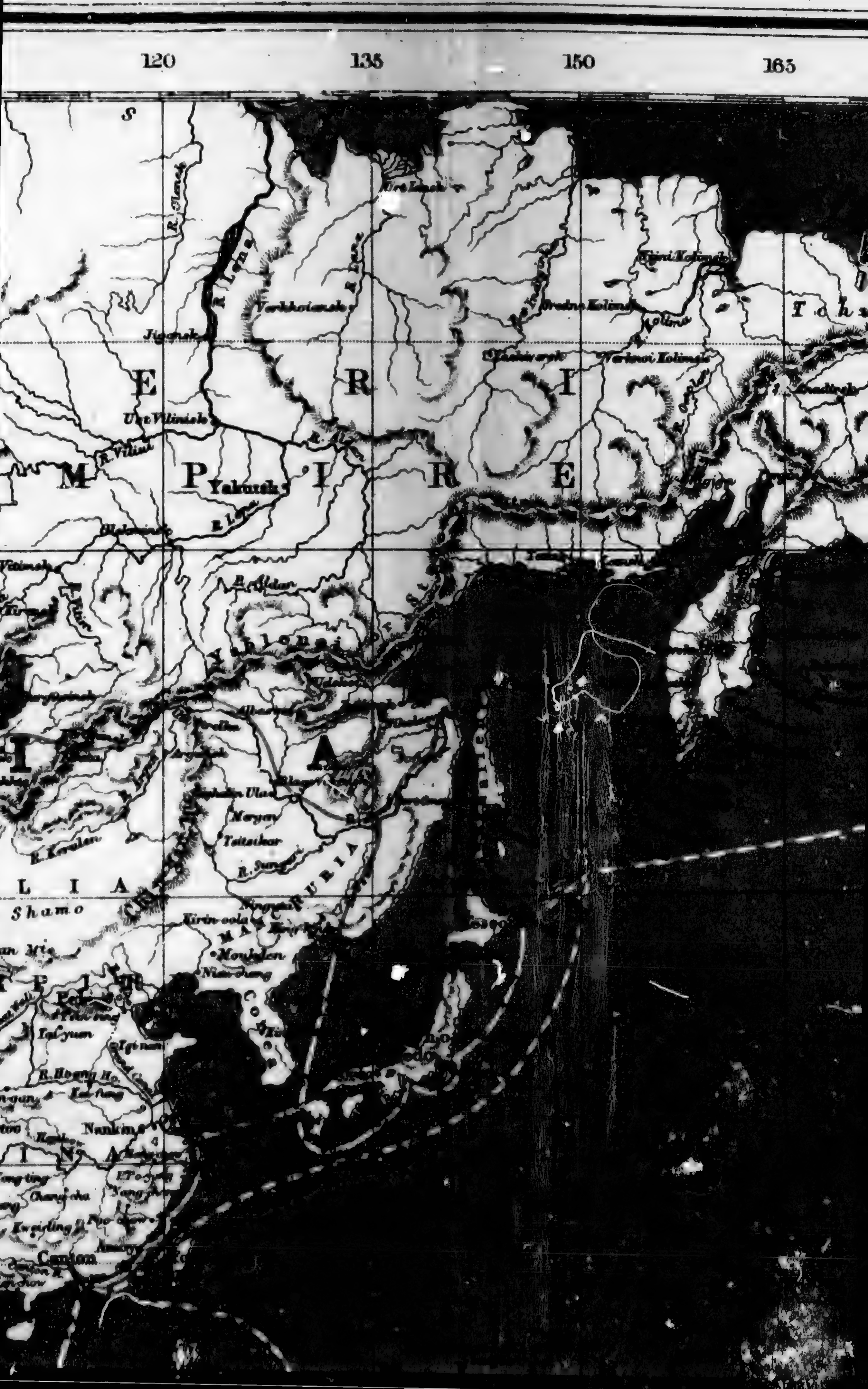
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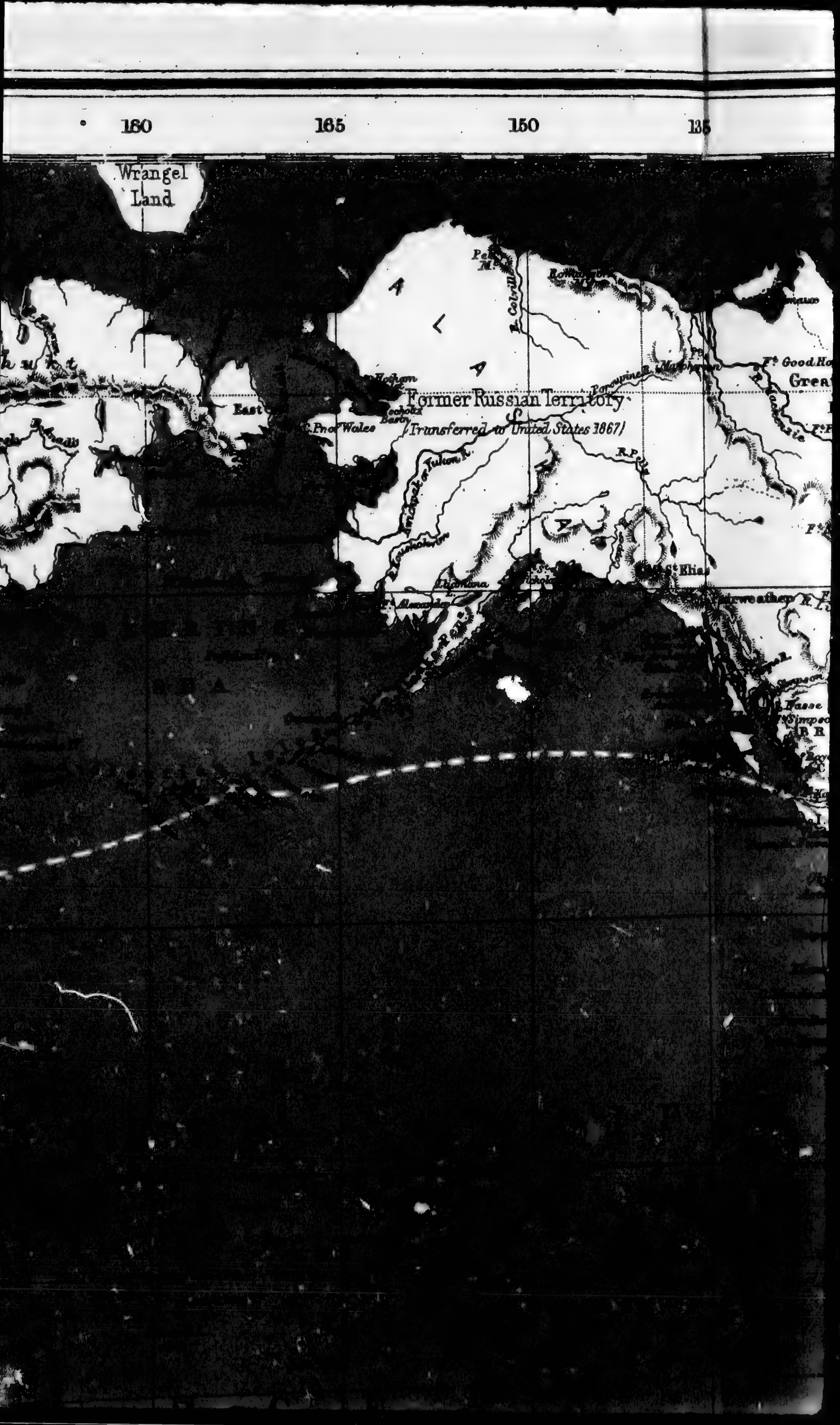
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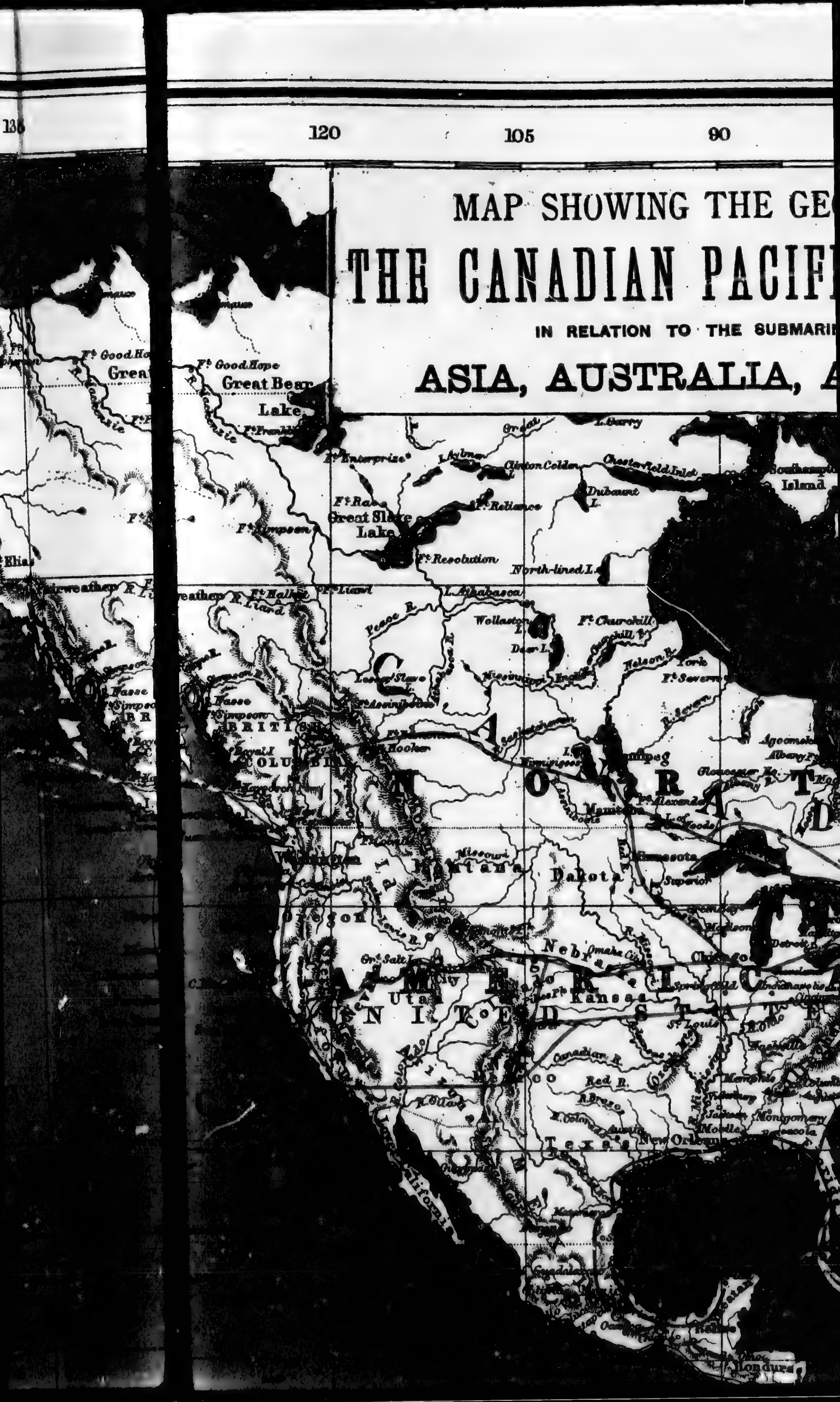
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MAP SHOWING THE GE
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Dubaunt L.
Ft. Reliance
Ft. Rae
Great Slave Lake
Ft. Simpson
Ft. Resolution
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Minnesota
Superior
Washington
Oregon
Nebraska
Omaha City
Madison
Chicago
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Gt. Salt L.
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Red R.
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Texas
New Orleans
Mobile
Montgomery
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Jackson
R. Gila
Mexico
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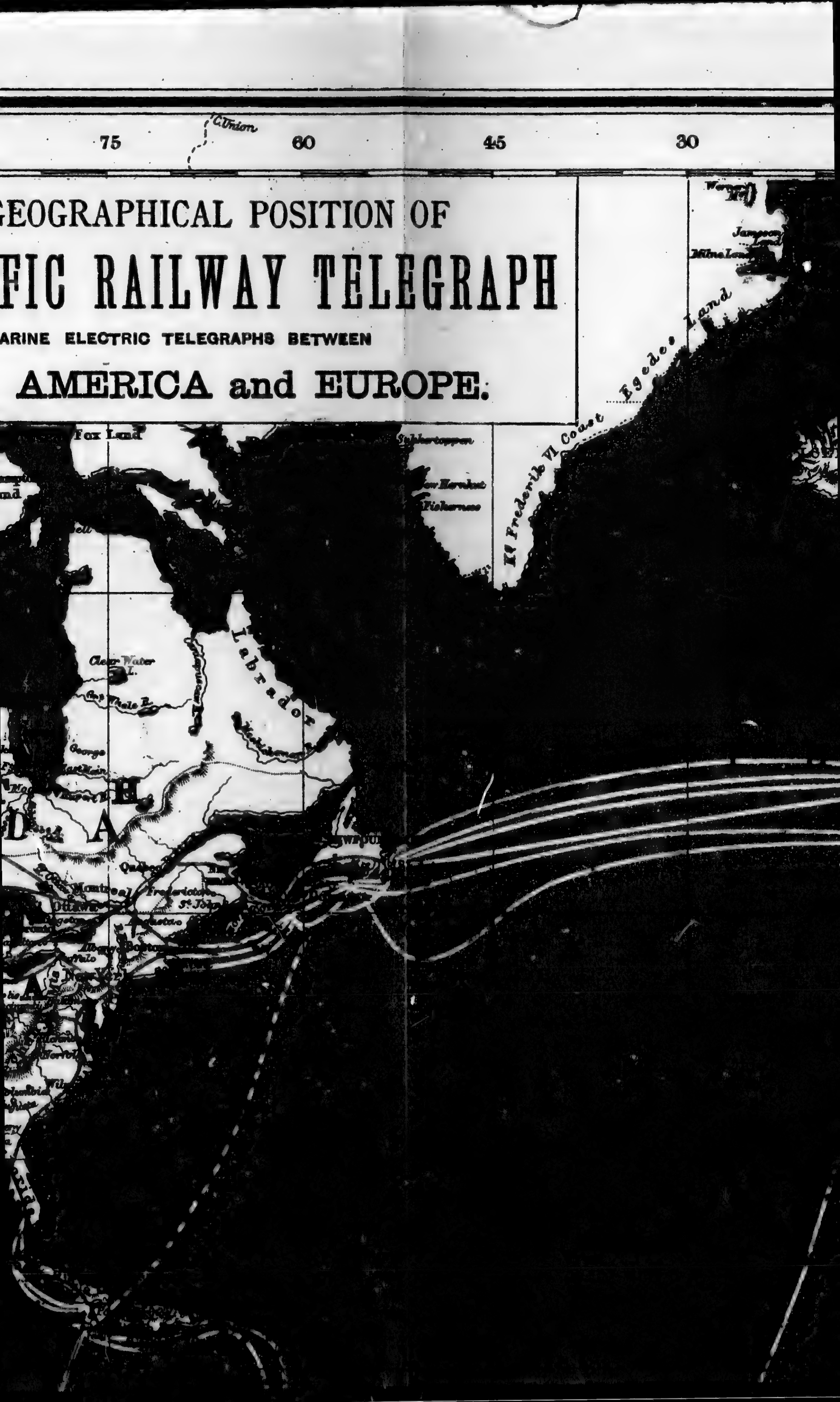

...GEOGRAPHICAL POSITION OF
...FIC RAILWAY TELEGRAPH
...ARINE ELECTRIC TELEGRAPHS BETWEEN
AMERICA and EUROPE.

**Plate No. 5.** *To a*

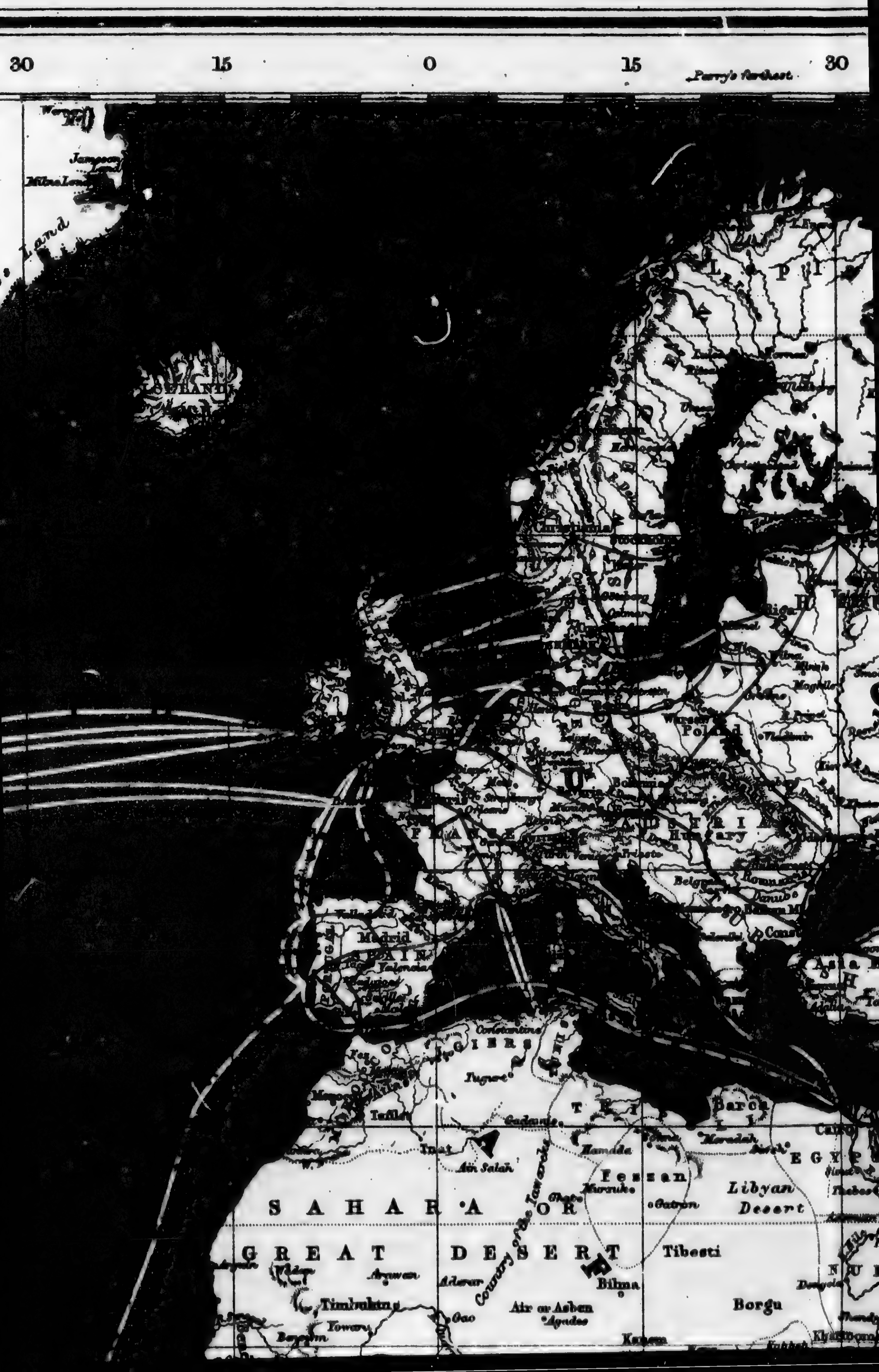

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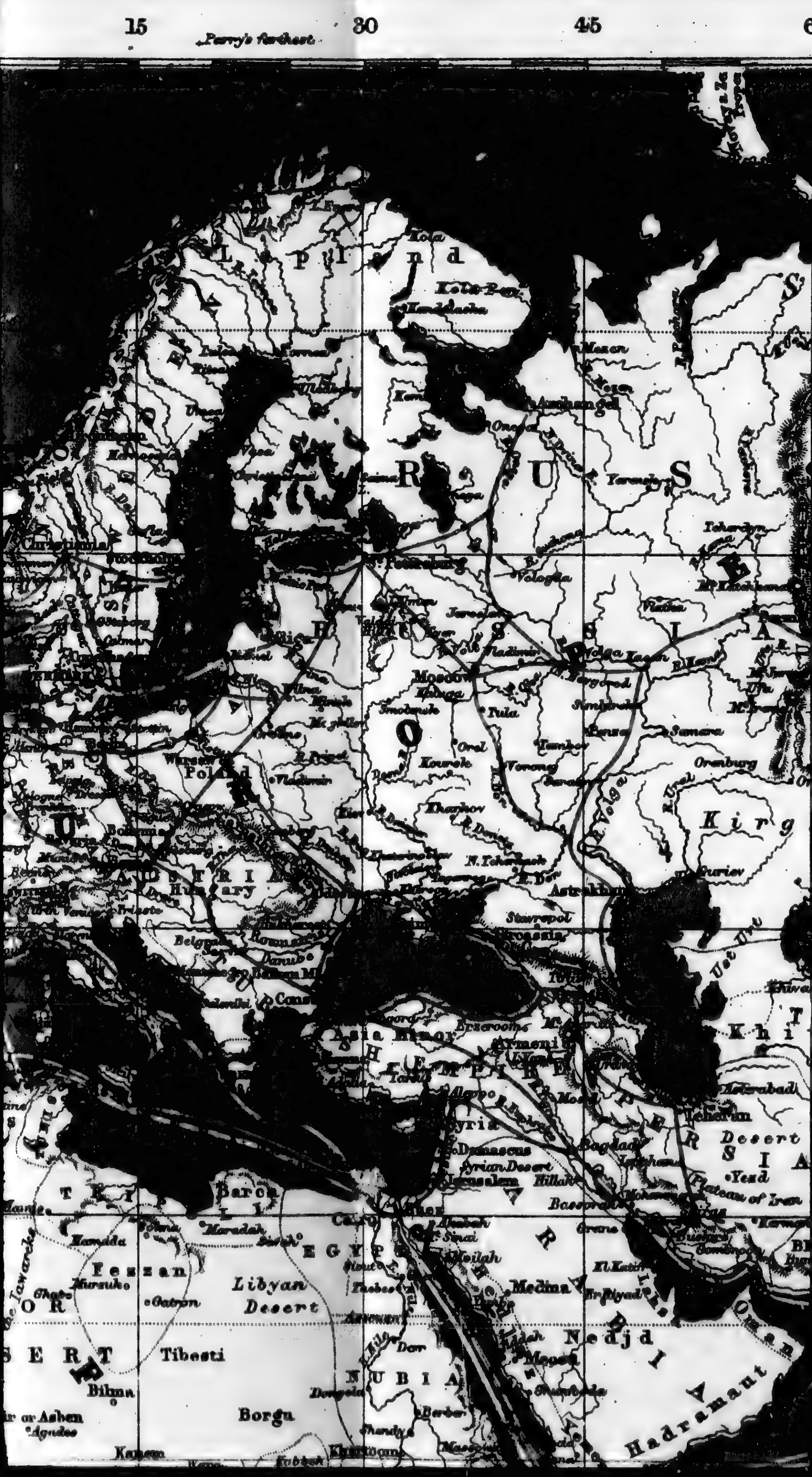
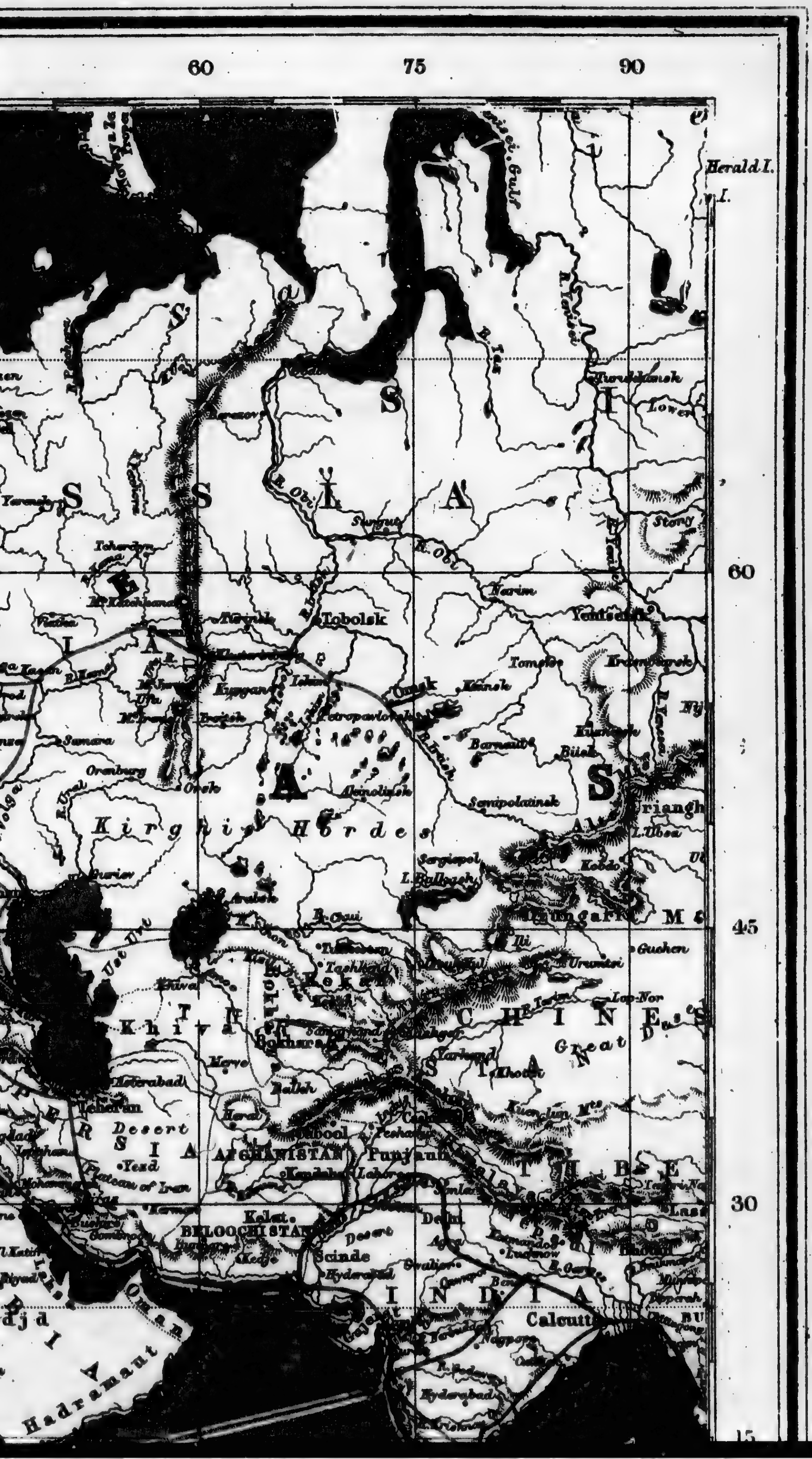
**Plate No. 5.** *To accompany Report of the Engin*



rt of the Engineer-in-Chief, Canadian Pacific Railway, 1880.



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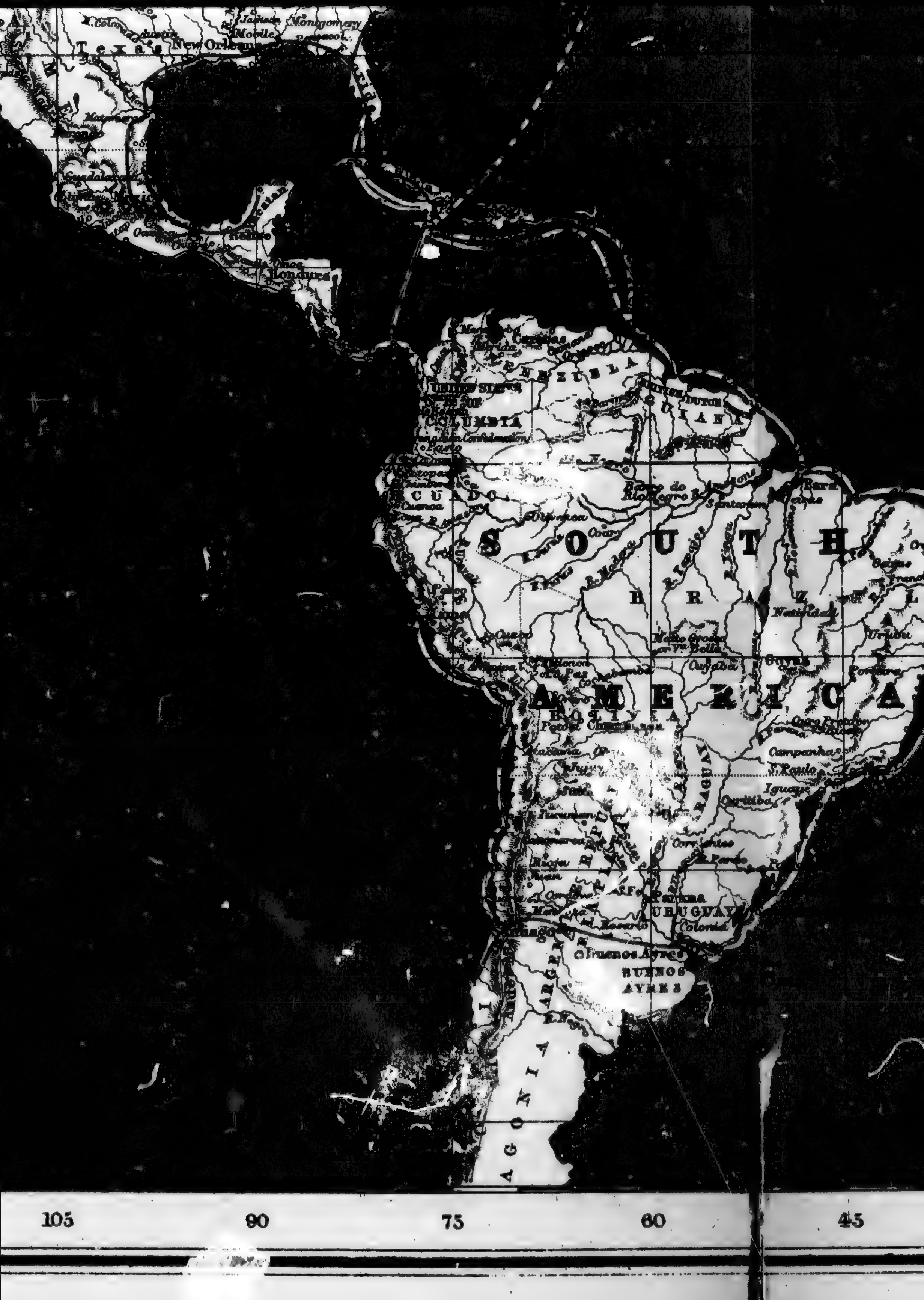
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SAHARA OR
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UPPER GUINEA
Coomassie
Ivory Coast
Yakoba
Rabba
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LOWER GUINEA
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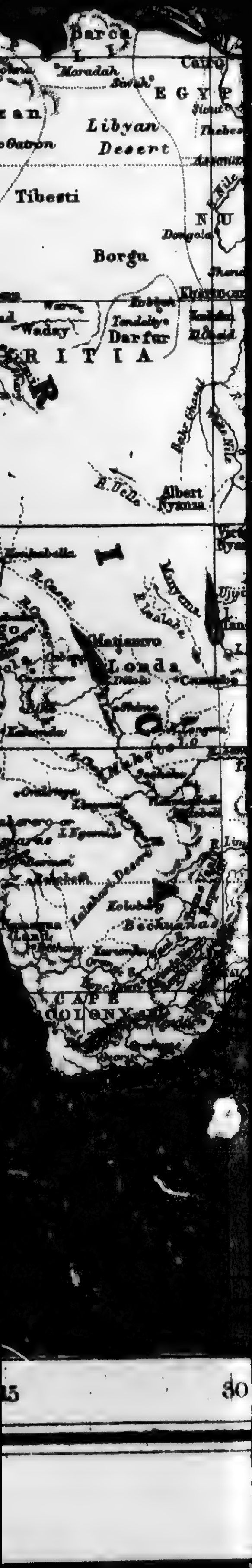
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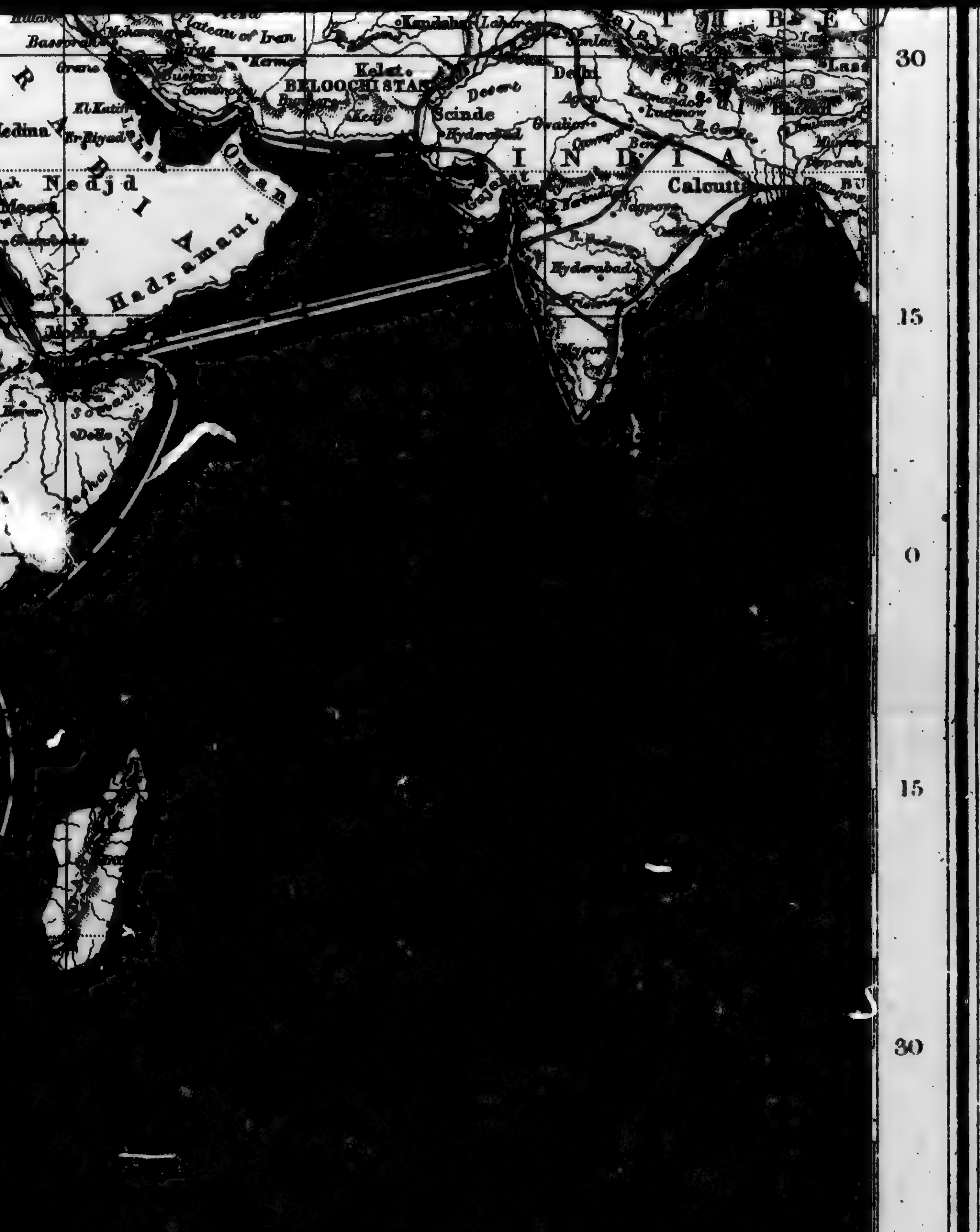

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# APPENDIX No. 1.

## INSTRUCTIONS OF THE ENGINEER-IN-CHIEF IN CONNECTION WITH EXPLORATIONS IN NORTHERN BRITISH COLUMBIA AND THE PEACE RIVER DISTRICT.

CANADIAN PACIFIC RAILWAY,
OFFICE OF THE ENGINEER-IN-CHIEF,
12th May, 1879.

*Memorandum of instructions for Mr. H. J. Cambie, Engineer in charge of Surveys in British Columbia.*

1. The object of the examination to be undertaken is to obtain definite data to determine if a northern route can be found by Peace River and the River Skeena or any of their tributaries, to Port Simpson.

2. The Engineer-in-Chief has at some length, personally, given explanation on this subject, and he has given in detail his own views as to the best mode of obtaining the result desired.

3. Mr. Cambie is aware of the character of the arrangement made for the delivery of the supplies at Fort St. James. He will himself proceed with Messrs. MacLeod, Keefer and Gordon to Port Simpson by steamer. It is desirable that personal examination be made of the Harbor and Wark Inlet. If he can lead the captain of the steamboat to place it at his disposal for so doing, it will be desirable to enter into an arrangement to that effect. But should it even not be possible to do so, steps must be taken by which the character of this navigation may be fully known. It is particularly of importance to learn if any serious difficulties present themselves in entering Wark Inlet from the ocean.

4. Mr. Cambie will leave Mr. Geo. Keefer and his staff in the neighborhood of Port Simpson to make certain examinations hereafter referred to; and he, Mr. Cambie, will himself ascend the River Skeena to Fort St. James, accompanied by Messrs. MacLeod and Gordon.

5. Mr. Horetzky has been instructed to explore the country between Fort Connelly and Fort McLeod, more particularly that portion north of the River Nation, and so to ascertain if a passage for a railway line, of a satisfactory character, can be found between one side of the country and the other, either by the branch of the Skeena in the immediate neighborhood of Fort Connelly and the Finlay a tributary of Peace River, or by any other branch or branches leading through to the Omenica District.

6. Mr. Horetzky will extend his examinations over the whole country between the Skeena and the Peace Rivers in this district as far south as the Nation. He will make such measurements as may be necessary to establish the nature of the country, and in order to determine what routes, suitable for a railway, are available.

7. I have given Mr. Horetzky verbal instructions to make full and exhaustive examinations of this district. If, on the completion of the work, time will admit, he will explore the country between Fort Connelly and River Nasse to the ocean.

8. Although Mr. Horetzky has been specially detailed for the service referred to, he will, in any question of doubt that may arise, refer to you. He has been informed that he must look to you as the senior officer in charge of all the examinations in British Columbia, and be governed by your views and directions, both with regard to the explorations, the matter of supplies and the means of transport.

9. It is the desire of the Government that the country should, with as little delay as possible, be thoroughly explored, so that the shortest eligible route between the River Skeena and the River Peace, or its tributary, Pine River, may be fully determined.

10. Instructions have been sent to Messrs. MacLeod and Gordon to accompany Mr. Cambie and to co-operate with him in this examination.

11. Mr. Dawson, of the Geological Survey, will also co-operate with the Pacific Railway Staff in the examinations of this season, more especially in the Rocky Mountains and along the eastern flank of the mountains. Every assistance will be rendered Mr. Dawson in the service in which he will be engaged.

12. Mr. Cambie, having made full arrangements to carry out the details as set forth, will probably meet Mr. Dawson at Fort St. James, or possibly before reaching that point, and will proceed with him and Messrs. MacLeod and Gordon to the Peace River. Mr. MacLeod has instructions what course to take, having arrived at this locality. Mr. Cambie himself will return by the Pine River Pass, so that a complete and thorough exploration can be made of this district.

13. Arrangements are made to send Mr. Tupper from Winnipeg to Edmonton, and thence as directly as possible to Dunvegan. The animals in this pack train will be available to bring back the information which may by this time, have been gathered. Consequently, Messrs. Cambie and MacLeod will prepare a full report, up to date, which will be forwarded by Mr. Gordon, who will return at once by the pack train to Edmonton. He will likewise convey to the nearest telegraph station (possibly at Edmonton) a condensed account of operations, which, in the form of a telegraph report, can be sent to Battleford and thence by telegraph to Ottawa.

Mr. D. M. Gordon will be attached to the expedition to assist as above set forth and to carry out certain special instructions which he has received.

Mr. George Major will accompany Mr. Cambie to British Columbia as accountant, and his services will be made available in connection with the operations of Mr. Geo. Keefer, respecting which special instructions will be furnished.

Should any additional assistants be required, Mr. Cambie will use his own discretion in employing or re-engaging any gentleman available in British Columbia. Any not required, who may now be employed, will be relieved of their duties and paid off.

Mr. Cambie will report as frequently as possible during the progress of the examinations.

S. F.

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12th May, 1879.

*Memorandum of instructions for Mr. H. A. F. MacLeod.*

Mr. H. A. F. MacLeod will accompany Mr. Cambie from Canada, and will act in concert in the examinations ordered by the Engineer-in-Chief, between Fort Simpson and the Peace River.

1. Wark Inlet:—Its character; the nature of the current; its anchorage; and the feasibility of a connection, at the head of the inlet, for sea-going vessels, with a railway line up the River Skeena.

2. A connection by railway between Port Simpson and the isthmus at the head of Wark Inlet.

3. The feasibility of a railway by the valley of the River Skeena to the centre plateau of British Columbia, and thence across the mountains to the Peace River District.

4. Mr. MacLeod will remain in company with Mr. Cambie, acting with him, observing all the points to be noted, making himself acquainted with the country until they reach Dunvegan on the Peace River.

5. Mr. Cambie has received full instructions as to the duties of Mr. MacLeod; of his acting with him till the point of Dunvegan is reached, and has been further informed as to the instructions given to Mr. MacLeod to make himself master of all the data known.

6. Mr. G. M. Dawson, of the Geological Survey, has received instructions to co-operate in the examination now being made of this northern district to determine its feasibility for a line of railway.

7. Dunvegan has been adopted as a point of rendezvous, Mr. Dawson reaching it by way of Pine River Pass; Messrs. MacLeod, Cambie and Gordon by way of Peace River; Mr. Tupper by way of Edmonton.

8. From Dunvegan Mr. Cambie will return to British Columbia by way of Pine River Pass; Mr. Gordon will proceed to Edmonton. Mr. Tupper will be available for examinations on both sides of Peace River, north of latitude 56°.

9. From Dunvegan Messrs. Dawson and MacLeod will make as thorough examinations as possible of the country between Peace River and Lesser Slave Lake, and the Rocky Mountains, to the south and west, extending their examinations to the located line west of Edmonton. It may be found advisable to trace Smoky River, and the other tributaries of Peace River, from the south until the mountains are reached.

10. It is essential that the information obtained as to the crossing of the valleys, be full and reliable. The information must embrace the width of the valley, the depth, the approaches, the volume of the water of the stream, the depth of the water, and such information as is usual in railway examinations.

11. This examination must be obtained from exploration. The Engineer-in-Chief, trusting in the experience, zeal and discretion of those engaged, appends no details as to the mode in which information should be gathered, but while full and embracing the several points involved, he enjoins that it must be obtained rapidly and without extraordinary expense.

12. The object for which this examination is being made must be borne in mind: it is to determine what route can be found feasible for railway construction. If, therefore, localities present themselves in which excessive grades or heavy work are threatened, an examination must be made to determine if these suggestive difficulties are absolute, or if there be the means of passing them by, by a detour of the route or other means, or whether such objectionable features are insuperable, and form a part of this route, not to be set aside.

13. The Engineer-in-Chief trusts that Mr. MacLeod, with the assistance of Mr. Dawson, will be able to report fully on the whole region lying south of the fifty-sixth parallel, and east of the mountains to the 112th meridian, having special regard to the practicability of a railway by the shortest line from Lac la Biche to the Peace River or Pine River Passes; and also, from the located line west of Edmonton, say at Southesk, across north-westerly to Pine River Pass.

14. Mr. Tupper has been instructed to proceed by Winnipeg to Edmonton, thence in a direct course from Southesk (Dirt Lake), across the Rivers McLeod and Athabasca to Dunvegan. It may be inferred that Mr. MacLeod will meet Mr. Tupper at Dunvegan, or between Dunvegan and the River Athabasca.

On meeting Mr. Tupper, Mr. MacLeod will transmit such reports as he and Mr. Cambie may have prepared of the proceedings up to date, and a synopsis of his report is to be sent as a telegram. Mr. Gordon will carry these despatches by the returning pack train, and will forward the short report from the nearest telegraph station probably Edmonton.

Mr. MacLeod will instruct Mr. Tupper to explore the country lying to the north of the 56th parallel, on both sides of Peace River; he will pierce the country to the right and left to ascertain how far good land extends, and before his return he will take every means in his power of gaining as complete a knowledge as possible of the physical character of the unexplored country as far north as the latitude of Lake Athabasca; he will lay down all the tracts of his exploration with reasonable accuracy on the map, and describe fully all the features of the country which he may personally examine.

I have given Mr. Gordon verbal instructions with respect to the duties expected of him, both before and after reaching Edmonton.

S. F.

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May 10th, 1879.

LaTouche Tupper, Esq.

Dear Sir,—Mr. Fleming has directed me to send you to meet me from the east, somewhere in the neighborhood of Fort Dunvegan, Peace River.

You will, therefore, be good enough to proceed as quickly as possible to Winnipeg, where you will meet Mr. John Brown, who will accompany you on the journey.

Your route from Winnipeg should be by the best route to Edmonton, thence to Dirt Lake, on the Lobstick River, and thence on a course as nearly as practicable north 47° west due, or north 73° west *magnetic*, the variation of the compass being about 26° east.

While keeping as near the above general course as the nature of the country will admit, you will, with the assistance of Mr. Brown. endeavor to find the best ground for your trail, following openings in the woods where they maintain the proper direction.

Mark your trail *well* in the woods with blazes, and in the open by poles, set up at intervals, writing *frequently* your name and the date on which you pass the particular point. Should you cross any of my trails, you will find them marked in the same way.

You will estimate the distances you travel as nearly as possible, also the depths of valleys, heights of hills and size of rivers and streams, keeping a regular diary of each day's work. Note also the character of the soil, timber and country generally, and the extent, as far as practicable, on each side of the trail.

Keep a good look-out for signs of Mr. Dawson's, or any party, when you get to the neighborhood of Peace River, and signal your presence by firing guns or by making smoke, when opportunity offers.

Take with you, intact, from Winnipeg to the neighborhood of Fort Dunvegan, supplies for 15 men for one month, amounting to about 900 lbs. flour and 700 lbs. of best bacon, with a proper proportion of beans, dried apples, tea, sugar, etc. And leave at Edmonton a like quantity of each article, to be used on the return. None of the above supplies are to be used till you meet me or Mr. Dawson from the west.

You should take with you for your use on the journey, about five months' supplies for, say, 5 men, amounting to 1,500 lbs. of flour and 1,200 lbs. of best bacon, with other necessaries in proportion. And take a sufficient number of horses and carts, with packing gear, as Mr. Brown may judge necessary, to carry out the above programme.

Should Mr. Brown judge that the country over which you will pass to the northwest of Dirt Lake be too rough to carry the month's supplies with you, you will leave them at Lake St. Anne's, and when you find that the trail is practicable to the open country about Peace River, you will send back and get them brought on.

You will endeavor to push forward as quickly as possible, having due regard to the animals, and keep yourself fully engaged in examining the country.

I am, yours truly,

(Signed) HENRY A. F. MacLEOD.

*Addenda by the Engineer-in-Chief.*

12th May, 1879.

It is important that Mr. Tupper should reach Dunvegan, on Peace River, by the time Mr. MacLeod arrives at that point from the Pacific Coast. Mr. Tupper will accordingly push forward with all speed. It is equally important that he should travel as nearly as practicable in a direct course from Southesk (Dirt Lake) to Dunvegan, but as the route is untravelled, he should go light from Edmonton; he will therefore leave the main part of the supplies, say, at Edmonton. Mr. MacLeod is instructed to send despatches to me from Dunvegan; he will accordingly send back Brown as far as Edmonton to return with the supplies left there.

S. F.

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12th May, 1879.

*Memorandum of Supplementary Instructions for Mr. H. J. Cambie.*

1. Before leaving the coast in the neighborhood of Port Simpson, Mr. Cambie will instruct Mr. Geo. Keefer to make a survey from the head of Wark Inlet, across the isthmus of some six miles to the River Skeena. He will select a point for the commencement of this survey that could best be reached by sea-going ships, so that materials for construction could be transferred direct from vessels to the railway.

2. The survey will extend from the isthmus by the best ground up the valley of the Skeena, and should be of such a character as will admit of an estimate being formed of the work which may be required to construct a railway.

3. The survey will be made in ten-mile sections, the plans and profiles will be plotted in camp, and immediately on the completion of the first section of ten miles, Mr. Keefer will forward tracings of plan and profile, and approximate full bill of works for that section to the undersigned, at Ottawa. As the survey advances, each succeeding ten miles will be similarly reported, and Mr. Keefer will be careful in estimating the quantities, that liberal allowances be made to cover contingencies.

4. The survey will be continued up the River Skeena as far as time will allow, but Mr. Keefer will bear in mind the importance of effecting, during the season, an examination of Wark Inlet, with sufficient number of soundings to establish any shoal that may exist.

5. It is important that a full knowledge be obtained of the nature of the currents and of the character of the anchorages in Wark Inlet and its approaches.

6. Mr. Keefer will likewise make such examination as may be necessary to determine the feasibility of carrying the railway along Wark Inlet to Port Simpson.

7. Mr. Keefer will make every enquiry with respect to fogs, ice, rain, snow and other climatic features.

8. In Mr. Cambie's absence in the interior, Mr. Keefer will be good enough to report to the undersigned as frequently as possible. He will lose no time in forwarding plans, profiles and quantities of the first ten-mile section, and all information he may gather and opinions he may form respecting Port Simpson as a harbor, and Wark Inlet as a temporary point of connection with a line of railway.

S. F.

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13th May, 1879.

*Memorandum of Supplementary Instructions for Mr. H. F. MacLeod.*

The instructions which were sent to you yesterday, were hurriedly prepared, and lest the undersigned may not have fully explained his views and the immediate object of the examination, the following is added:—

It is of the utmost importance that the Government should be placed in possession of certain information, at the earliest moment, in order that a judgment may be formed respecting the several routes to the Pacific Coast.

The result of the examination this season will form an important element in the consideration of the question, and I look to Mr. Cambie and yourself to furnish without delay information on the leading points.

1. Referring to the accompanying map, we have information which goes to show that a railway can be built by the red line from Fort George to the point A, on Pine River, on the eastern side of Pine River Pass; but we have to establish whether or no, a railway can be built from A, on or near the red line, to Lesser Slave Lake, or whether or no, it would be expensive, or with favorable or unfavorable gradients.

2. On the map I have drawn a blue line from A to the located line in the neighborhood of Southesk or the crossing of the Pembina River. This, for some reasons, is thought to be a desirable location for the railway, and possibly on or near this line, the deep valleys on the red line, above referred to, from A to Lesser Slave Lake, may in part be avoided.

3. We require definite information with respect to both lines, and the undersigned would wish you, with the co-operation of Mr. Dawson, to endeavor to get some general information which you can send by Mr. Gordon.

Assuming that you will reach Dunvegan before Mr. Dawson reaches the point A, you could possibly communicate with him and induce him to tr[illegible] A and proceed south-easterly on the general direction of the blue line until you meet him. In the meantime, Mr. Cambie and yourself could divide the work of examination between A and Lesser Slave Lake (B), on the red line; Mr. Cambie beginning at one end, yourself at the other, meeting midway, then joining Mr. Dawson on the blue line and following its general direction, probably, until the Athabasca is reached.

This course is suggested in order that the information required be obtained as speedily as possible. On meeting Mr. Cambie, at the middle of the red line, there would be no necessity for him continuing with you southerly; he could then, assuming that he began the examination near B, continue westerly through Pine River Pass, according to his original instructions.

An exact copy of the enclosed map will be kept here in the office, so that when you refer, in the report you will send by Mr. Gordon, *viâ* Edmonton, to the blue or the red lines east of the mountains, your telegraph messages will be understood.

With regard to the blue line from Fort St. James to Fort McLeod, you will, I trust, be able to say if it be practicable or favorable. Perhaps you may be able to indicate if there be reasonably fair prospects of getting a shorter route between the Peace River and the Skeena.

We already know that we can reach Port Simpson *viâ* Yellow Head Pass and Fort George. The undersigned trusts that the present examinations will enable you to report by Mr. Gordon if a line be feasible by way of Edmonton and Pine River Pass, how it will compare in respect to distance with the line *viâ* Yellow Head Pass and Fort George, and what sort of country it will pass through.

You will also be able to say something about the red line from A to B, but east of B, you will, at the date of Mr. Gordon's leaving you, have no information.

S. F.

P.S.—A copy of this memo., with map, is sent by Mr. Tupper for his information, along with the enclosed note.

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6th June, 1879.

### *Memorandum of Instructions for Captain J. C. Brundige.*

Having represented to the Honorable the Minister of Railways and Canals the necessity of procuring additional information respecting the coast of British Columbia, the approaches by sea, and the several harbors available for a terminus for the Pacific Railway, the Minister has appointed you to proceed to British Columbia and undertake an examination.

I have furnished you with copies of my Pacific Railway reports, embracing the testimony of different naval authorities. On perusing them you will find that our knowledge of the northern portions of the coast of British Columbia is deficient. It is important that we should, as far as practicable and as soon as possible, make good the deficiency. You will, accordingly, lose no time in proceeding to British Columbia and find your way north, to where the enquiry is to be made. In conversations which you have had with the Minister and myself, you have been made aware of the nature of the information which we require, and you will make every effort to procure it. When you reach the River Skeena, you will find that surveying and exploring parties, under the general charge of Mr. H. J. Cambie, have entered the interior in that latitude.

Some time will elapse before Mr. Cambie's return to the coast, but you will probably find one party on the River Skeena, in charge of Mr. Geo. Keefer. Should you be in need of assistance, you can apply to that gentleman; but as his duties are quite distinct from yours, you need not go out of your way to meet him, unless you find it necessary to do so.

While you will gather information from every source, you will take special care to form your own opinions from your own observations, free from all preconceived ideas, and you will, once a fortnight, or as frequently as you have an opportunity after leaving Victoria, convey to me an account of your progress and the impressions you may form both with respect to the harbors, the approaches from sea, and the climate. At Metlahkatlah, and wherever you can gain reliable information, you will make particular enquiries respecting the winters, their length, severity, the prevalence of winds, fogs, snow, ice., etc., and how the climate may compare with Nova Scotia, the west coast of Scotland, Denmark, or that of other well-known parts of the world in corresponding latitudes.

(Signed) SANDFORD FLEMING,

*Engineer-in-Chief.*

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# APPENDIX No. 2.

## REPORT ON AN EXPLORATION FROM PORT SIMPSON VIA THE RIVER SKEENA, LAKES BABINE AND STEWART AND THE PEACE AND PINE RIVER PASSES TO LOWER SLAVE LAKE, IN THE YEAR 1879, CONDUCTED BY MR. H. J. CAMBIE.

NEW WESTMINSTER,
BRITISH COLUMBIA, Jan. 20, 1880.

SIR,—I have the honor to submit the following report on the survey and explorations made, during the summer of 1879, to determine if a northern route could be found by Peace River and the River Skeena, or any of their tributaries, to Port Simpson on the coast of British Columbia.

Messrs. Macleod, Keefer, Gordon and myself left Ottawa on May 12th and reached Victoria, British Columbia, on the 24th. Dr. G. M. Dawson, of the Geological Survey, and Mr. Horetzky, having joined us at San Francisco on the 19th.

We spent ten days in Victoria making preparations, and on June 3rd sailed northward in the Hudson Bay Company's steamer " Princess Louise."

The men and supplies were landed at Port Essington on the 5th and the steamer was then placed at our disposal for the examination of Port Simpson and the Wark Inlet.

We proceeded the same evening to Metlahkatlah, where we had the advice and assistance of Mr. Duncan, the Church of England Missionary, in engaging Indians with their canoes to take us up the Skeena, where we anchored for the night.

### METLAHKATLAH.

This is a poor harbor for large vessels, the channel being narrow and tortuous, and the inner part is so small as to afford but a very limited amount of accommodation. It is, however, admirably adapted for the use of canoes, as it is connected with a number of land-locked channels by which the Skeena River can be reached without facing the open sea.

### PORT SIMPSON.

The following morning we got under way about 3 a.m., and passing northwards between Finlayson Island and the mainland, entered Port Simpson by the channel to the eastward of the shoal known as Harbor Reefs. We remained in the harbor for about two hours and, the tide being out, had an opportunity of observing that, within the dotted circle marked on the charts around Harbor Reefs, and which is there shown as being largely composed of kelp, the greater part was left bare at low water. By inspecting the chart it will be seen that within the southern part of the harbor, protected by this reef from the ocean swell there is an area of about one half mile by two. In the northern part there is a well-sheltered bay inside Birnie Island, about three quarters of a mile square. These, with the land-locked bay east of Finlayson's Island, afford about five miles of water frontage on the mainland, besides a large extent on the surrounding islands.

The islands and reefs which inclose the harbour being low, vessels would not be protected from wind should it blow a gale from the west. This, in the case of small sloops, such as those which now trade along the coast, might cause inconvenience, but large vessels may be considered safe when in calm water, and westerly winds are not the prevailing ones in the winter when gales most frequently occur.

The shores of Port Simpson rise gently from the water's edge and are well adapted for the site of a city.

There is much rain in summer and frequent snow storms occur in winter, but the snow seldom lies on the ground for more than a few days.

Were suitable lighthouses and fog-signals erected on some of the northern points of Queen Charlotte Islands and southern points of Alaska, as well as on other rocks and points nearer the harbor, it seems to me that Port Simpson would be in every way suited for the terminus of the Canadian Pacific Railway.

In this opinion I am partially borne out by Commander Pender, the naval officer who conducted the survey of that part of the coast. See the report of 1877, page 295, where, in reply to question 25, he describes Port Simpson as the "finest harbor north of Beaver Harbor in Vancouver Island."

On page 297, of the same report, in reply to question 28, Admiral Cochrane mentions that "little or no difference was found in the temperature of the sea at that latitude (Port Simpson) and at Vancouver," and mentions this fact amongst others to show that the climate is tempered by ocean currents.

We left Port Simpson by the Inskip passage, which is a magnificent entrance, being about half a mile wide and free from strong currents or obstructions of any kind, and steamed around to Wark Inlet.

### WARK INLET.

A nautical survey of the coast of Northern British Columbia was made by Commander Pender, and no doubt the entrance is correctly placed on the Admiralty Charts, but the channel itself has not been surveyed, and is incorrectly sketched.

Point Wales is situated opposite the entrance, and would appear, from the chart, to be only about three and a half miles distant, while in reality it is little, if any thing, short of eight miles distant. This is a matter of some importance, for it is the southern extremity of Alaska, and were it as close as is shown, a battery placed there by the Government of the United States could prevent vessels entering or leaving Wark Inlet.

Wark Inlet is easily approached, there being plenty of sea room; the entrance is 1,500 or 2,000 feet wide; a mile farther in, it narrows to about 1,000 feet, but soon opens out again, and then averages one mile in width all the way to its head.

There is an 18 feet rise and fall of tide, which causes a swift current in the narrow entrance; but we saw no sign of eddies, though we passed through at about three-quarter ebb, when it had a velocity of, perhaps, four miles per hour.

We tried a few soundings and found bottom at 38 fathoms, about four miles inside the entrance, but failed to find it again, with 76 fathoms of line, till within half a mile of the head of the inlet, where it is 58 fathoms deep, sloping gradually from that point to the beach, so that the space fitted for anchorage is very small.

The shores are well suited for the building of wharves, and would afford about two miles of water frontage; but their construction would be expensive, as the rock bottom would prevent the use of piles. The area of land suitable for a town site, is very limited, the hills rising abruptly from the shore on both sides of the channel. The only really available space is in a valley leading from the head of the inlet to the Skeena, not exceeding half a mile in width.

If it should at any time be determined to build a line of railway by the valley of the Skeena to Port Simpson, the head of Wark Inlet could be used as a temporary terminus; but the accomodation both for railway and shipping would be very much contracted.

In extending such a line down the T'Simpsean Peninsula to Port Simpson, it would have to follow closely by the shore of Wark Inlet, and as the hills rise directly from the water's edge at slopes of one in two or one in three, except for about four miles nearly opposite the Quattoon Inlet, where they average perhaps one in one, much curvature would be required and the excavation would be in rock, but would not be excessive in quantity, except for the four miles above referred to, where there are also some snow-slides to be provided against; these come, however, from heights of only 300 to 400 feet, and should not be classed with the avalanche courses met with in the valleys leading to Dean's Canal, Bute Inlet or on the River Skeena.

In rear of Port Simpson is a low tract of country extending across to Wark Inlet, so that a line could be brought to any part of the port with ease.

Having finished our examination early in the afternoon, we steamed around to the Skeena the same evening and landed at Port Essington about 7 p.m.

The canoes which had been engaged at Metlahkatlah the day previous were there waiting our arrival.

### SKEENA RIVER.

On the next day, June 7th, we parted from Mr. G. A. Keefer, who, with his party, was to make a trial location for a line of railway from the head of Wark Inlet across to the Skeena, and up its valley as far as the season would permit; Mr. Horetzky remained behind at Port Essington to complete his preparations for exploring the country between the Skeena and Peace Rivers; and Messrs. McLeod, Dawson, Gordon and I started up the Skeena River in two canoes, manned by five Indians each, making all possible speed to reach Fort McLeod, on the head waters of the Peace, where our more important work was to commence.

Our progress was slow, for the river was in a high stage of flood, and we did not reach the "Forks of Skeena" till the 21st.

It is unnecessary for me to enter into any description of the Skeena Valley, as I have already expressed my views regarding its feasibility as a railway route, in a memorandum dated April 23rd, 1878, and published in your report for that year, page 38. My opinions are borne out by the result of Mr. Keefer's survey, of which the plans, profiles and estimates for sixty miles, with his report, are now submitted to you. In that memorandum I mentioned to you that some of the residents at the Forks were growing oats for the first time, and had just obtained a small herd of cattle. They have since harvested two good crops of oats, and found that cattle can be kept with profit.

On my former trip up the Skeena, in 1877, I ascertained that it was practicable to construct a line of railway from the "Forks" to Fort George, by way of the Watsonquah and Nechacoh Rivers, and so to connect the Skeena with the line which had been already located from that point to the eastward by the Yellow Head Pass. But the object of this examination being to ascertain if there was a practicable route from the Skeena to the Peace River, we engaged a number of Indians to pack our camp, equipage and supplies, and travelled eastward by the Susquah River trail, which brought us to Babine Lake, close to its outlet,

### TRAIL FROM SKEENA TO BABINE.

The summit of the valley through which this trail passes is about 3,700 feet above the sea, and could be crossed by a line of railway, but would entail gradients of 100 feet to the mile, or even steeper, accompanied by heavy works of construction.

### BABINE LAKE.

At the northern end of Babine Lake the land slopes gently up from the shores, and the mountains are some miles back, presenting in this respect a marked contrast to most of the lakes which I have seen in British Columbia.

From a hill on the eastern side of the Babine River, we got a view down it to the north for a long distance, and could distinguish that for about twelve miles it was flowing in a wide valley. We also saw the gap in the mountains through which it empties into the Skeena about forty miles above the Forks.

Judging from our observations on this occasion, and what we had previously seen of the Skeena Valley by looking north-eastwards up it from the Forks, there seemed to be a fair promise of a practicable line being found by these valleys. Mr. Horetzky having been selected to make a detailed examination of this part of the country, we pushed on without delay.

On Monday, 30th June, we made an early start south-eastwards up the lake, in two small cottonwood canoes, and reached Fort Babine the same day.

In this distance of perhaps thirty miles the lake averages one mile in width, and we were surprised to find the land rising in easy slopes from it on both sides. On the east there is a ridge running nearly parallel to it about two miles distant, and increasing from 500 feet at its northern end to 2,000 feet in height near the fort. On the west side there is a high range of mountains, but between their base and the lake there is a tract of undulating land from three to eight miles in width, which is in some places heavily timbered with spruce; in others there is a light growth of poplar and spruce, and much of it would no doubt be found suitable for agriculture if the climate is not too severe.

Southward from Fort Babine for about forty miles, the lake varies from two to seven miles in width, and the shores continue of the same undulating character, with mountains from four to ten miles distant, covered with a light growth of poplar and spruce.

For the remaining thirty miles to the head of the lake, it averages 1½ miles wide with bold, rocky shores, and the land can never be of value for agriculture, though it may be used for pasture.

Judging from what is known of the climate of Stewart's Lake, and its position in regard to Babine, it is not likely that the latter will be found suited for the cultivation of wheat, but only for the hardier vegetables, with rye, and possibly oats and barley.

### PASSES TO THE EASTWARD.

A day was spent examining a pass situated opposite the fort, and leading to Tacla Lake. The summit is about four miles from Babine Lake and 970 feet above it. No doubt a favourable line can be found to connect this pass with the valley of the Babine River by leaving the latter about six miles below the outlet of the lake, and then following a chain of small lakes and rivers in a south-easterly direction to the head of the bay on which stands the fort; but whether it can be continued eastward to the head of the Nation or any other branch of the Peace River, by a route practicable for a railway, I am not in a position to state from personal observation, though several routes were described to us, and their advantages set forth in most glowing terms by persons who know the country well.

One of these is said to be by a pass leading eastward from Tacla Lake about six miles above its outlet, to the Nation; another very low pass leading from the north-eastern end of Trembleur Lake to a different branch of the Nation.

About thirty miles south of Fort Babine is a valley leading to Trembleur Lake, which is, apparently, at its highest point, not more than 500 feet above the lake. A waggon road was built through it in 1871 to facilitate travel to the Omineca gold fields.

### PORTAGE TO STEWART'S LAKE.

From the head of Babine Lake we crossed over to Stewart's Lake, by the Hudson Bay Company's cart trail, about seven miles in length. The lakes are on nearly the same elevation, 2,200 feet above the sea, and the highest point on the trail between them is about 400 feet.

We arrived at Stewart's Lake at 1 p.m. on July 4th, and at 10 the same evening Mr. G. R. Major arrived with a boat to take us to Fort St. James, which was most fortunate, as there was a difficulty in obtaining suitable canoes to proceed.

### STEWART'S LAKE.

Next morning, July 5th, we got under way at 5.30 a.m. and reached Fort St. James at 10.20 p.m., where we met the pack trains with an outfit for the exploration of the Peace River country.

Stewart Lake is about forty miles in length, and varies from one to six miles in width. At many places along its shores there is level or undulating land, extending back for several miles, covered with poplar and spruce.

Rain was falling heavily and a gale of wind blowing during part of our trip down the lake, and we consequently did not see the adjacent country as well as could be wished.

### PREPARATIONS FOR JOURNEY.

One day was spent at Fort St. James in rearranging provisions. A small pack train, consisting of seventeen animals and three men, was left under charge of Mr. Walter Dewdney to attend on Mr. Horetzky and take supplies to meet him at any point he might require them during the summer.

Our party, for the exploration of the Peace River country, then consisted of six on the staff, fourteen packers, besides two men and five Indians, who were to assist in boating, cutting trail, etc., being twenty-seven in all, and our train consisted of seventy-two pack mules with twenty-three riding animals.

This large number of animals was required because we proposed travelling where no trails existed, and they could carry but light loads.

Leaving Fort St. James on the morning of July 8th, we reached Fort McLeod on the 14th, about eighty miles. Here we divided our party, Mr. Dawson going east with the mule train by Pine River Pass, while we made arrangements for the rest of the party to descend Peace River in a boat which was obtained from the Hudson Bay Company.

### PACK RIVER.

Messrs. McLeod, Gordon and myself, accompanied by Mr. G. R. Major and four men, started down the Pack River on the afternoon of July 16th and reached its junction with the Parsnip next day.

The Pack River is about 150 feet wide, with a current of two to four miles per hour; it has low banks and could be bridged without difficulty at any point for five miles below Fort McLeod.

There are some fine prairies with luxuriant grass near the fort. The forest consists of spruce and poplar, with cottonwood next the river, and a few Douglas firs on the hill sides. This appears to be the northern limit of that tree, so far as our experience is concerned.

### PARSNIP RIVER.

On the 18th and 19th July we ascended the Parsnip, with much difficulty, owing to the swift current, as far as the mouth of the Misinchinca, about twelve miles, where we ferried Mr. Dawson, his men and supplies across, and swam the animals, and having appointed to meet him, if possible, at Fort Dunvegan, about Sept. 1st, returned the same evening to our previous camp at the mouth of the Pack River. This portion of the Parsnip River is 500 feet broad and flows in a valley about one-half mile in width.

At some of the bends it washes the base of clay and gravel banks, which at certain times when saturated with water, appear to slide in large masses and are then washed away by the current. These bluffs vary from 100 to 200 feet in height, being on the level of the adjacent country, which continues of the same general elevation on the eastern side for about eight miles back, till it meets the westernmost spurs or foot hills of the Rocky Mountains.

On the western side between the Parsnip and Pack Rivers, there is a range of hills running nearly parallel to the former, the peaks of which would not exceed 1,000 feet in height above the river. Through this range there is a low valley nearly opposite the mouth of the Misinchinca, by which our pack train had come.

On the banks of the river there are a few open prairies with rich grass, but the country generally is covered with a thick growth of spruce, poplar, birch and cottonwood.

On the 21st we continued our journey north-westwards down the Parsnip, stopping for lunch opposite the mouth of the Nation River, and to this point, about thirty-two miles, the foregoing description of the valley would apply in almost every particular.

The foot hills of the Rocky Mountains were seen only three times, and at distances estimated to be eight, twelve, and six miles respectively; the valley of the river being now some 20 to 25 miles across.

About fifteen miles west of the Parsnip the Nation emerges from the mountains, through a wide valley; and if a line of railway should ever be projected by that route it could probably be continued towards the Pine River Pass without any serious difficulty. In order to avoid land slides it might be kept a considerable distance back from the Parsnip, except at the crossing, for which there is a favourable place, about five miles above its junction with the Nation, where it is only about 300 feet wide with an exposure of rock on the left bank.

The river valley continues in the same direction and is of the same character for about forty-five miles further, or to the junction of the Parsnip and the Finlay Rivers. But rocky hills of 500 to 800 feet in height abut on it in a few places and would add much to the difficulty of extending a line eastward from the Nation by way of the Peace River Pass.

The land in the river bottoms of the Pack River and the Parsnip is generally rich, but that on the benches gravelly and poor.

The climate seems to be cold and damp, and the timber consists of spruce and poplar, with cottonwood on the islands and flats.

## PEACE RIVER PASS.

The Parsnip and Finlay Rivers are each about 500 feet wide at their confluence, and below that point the united stream is known as the Peace River, and immediately enters the pass of that name. This pass is bounded for about thirty miles by mountains rising from 4,000 to 5,000 feet above the water on each side, leaving a valley about half a mile wide between their bases, through which the river (600 to 800 feet wide) winds from side to side, having benches first on one side, then on the other, varying in height from 20 to 80 and sometimes even to 100 feet.

Though at a few points the northern side might appear the more favorable, the southern or right bank is the best suited for a railway line; on this, the work would be principally in gravel and very heavy, owing to the difficulty in getting from one bench to another, where they differ so much in elevation.

The only place where the actual mountain slopes abut on the river is for three-quarters of a mile at the base of Mount Selwyn, which is there bold and rocky, and rises at an average slope of one in three.

This would, of course, entail some heavy rock excavation; and about half a mile further east, a short tunnel would be required to pass under an avalanche course which sweeps from the same mountain. There is a good view of the mountain, showing the rocky slopes above referred to, at page 42 of the Geological Report for 1875-76, from a photograph by Mr. Selwyn, the Director of the Survey.

About five miles east of Mount Selwyn, a stream about 60 feet wide comes in from the south ; and 12 miles farther east another stream, about 60 feet wide, and the Clearwater, about 120 feet wide, also come in from the same direction. They are the only streams of importance to be bridged on the section under consideration.

The low flats are timbered with cottonwood, and the hillsides and benches with spruce, poplar and birch.

At the Clearwater the width of the valley from the base of the mountains at one side, to those at the other, is about half a mile, and between their summits, perhaps, four miles. From that point eastward, to the head of the Rocky Mountain portage, about 40 miles, the character of the country changes, the valley widens out to about two miles between the bases, and about six or seven miles between the summits of the mountains, which gradually decrease in height to about 1,200 or 1,000 feet, and their slopes become less steep and rugged. The benches are generally lower, being from 10 to 40 feet above the river, and at three points only do high ones abut on it, amounting in the aggregate to about a mile and a half; these, however, occur at places where the river is wide, and it would be possible to protect an embankment along the water edge: consequently the difficulties of railway construction would not be great.

Five streams have to be crossed, the two largest of which are respectively 150 and 50 feet in width.

The climate and vegetation show a marked change to the eastward of the Clearwater River, the slopes facing the south and many of the flats have some small clumps of spruce and poplar copse, and a large proportion of prairie producing good grass and pea-vine.

Near the Rocky Mountain portage there is some of the small variety of sage (*Artemisia frigida*), which is so characteristic of the dry southern portion of the interior of British Columbia.

We examined two of the low benches and found the soil to consist of a good sandy loam, but the upper ones appeared to be gravelly and poor.

## ROCKY MOUNTAIN CANON.

Three days were spent in crossing the portage with the aid of horses borrowed from the Hudson Bay Post at Hudson's Hope.

The portage, nearly 12 miles in length, runs nearly east and west, and was made for the purpose of avoiding the Rocky Mountain Canon, through which the Peace River takes a semi-circular bend to the south, about twenty-five miles in length.

To have followed it round would have entailed a delay of several days, as there is no trail, so we decided that Mr. McLeod should cross over to Hudson's Hope with the first loads and examine as much as possible of it from that end, while I did the same from the upper end.

In pursuance of this plan, I followed down its left bank for about four miles, and had a good view for about four miles further.

In this distance the river runs generally through a gorge about 400 to 600 feet wide with sandstone bluffs rising perpendicularly from 100 to 300 feet on either side. The surrounding hills vary from 1,000 to 2,500 feet in height above the river, and slope down to the precipice at the rate of one in two to one in five; they are also much broken by ravines, so that a line of railway would require many sharp curves, high bridges and long tunnels, and the expense of construction would be excessive.

From the junction of the Parsnip and the Finlay, the Peace River flows nearly due east for upwards of 250 miles, to the mouth of Smoky River, where it turns sharply to the north and leaves the section of country embraced in our examination.

Hudson's Hope may be said to be on the eastern edge of the foothills of the Rocky Mountains, their base then extending in a south-easterly direction past the lower end of Moberly's Lake, crossing Pine River a little to the west of the main fork.

### HUDSON'S HOPE TO PINE RIVER.

The country east of Hudson's Hope is generally a great plain or plateau averaging about 1,900 feet above sea level, through which the Peace River flows in a trough or valley about 700 feet deep at first, increasing to upwards of 900 feet in the neighborhood of Smoky River.

As far east as the mouth of Pine River, about fifty miles, the valley varies from one and a half to three miles in width at the level of the plateau, and one-half to two miles in the bottom.

The river varies from 900 to 1,200 feet in width, and wherever it washes the base of the hills on either side, extensive land slides occur. Those of recent date, on the south side, amount in the aggregate to more than two miles, beside a much greater extent of old ones, which may start again any day. They offer an almost insuperable obstacle to railway construction close to Peace River, for if it were attempted to build an embankment in the water at their base, it might be overwhelmed at any moment by great masses of earth; while the tributary streams have cut such deep lateral valleys, that if a line were taken up sufficiently high to pass behind the land slides, the crossing of each little brook would require a structure of gigantic proportions.

The earth in this section of country contains a large proportion of alkali, and I cannot help associating its presence with the land slides. When saturated with water, it dissolves and facilitates the movement of the mass of earth which may happen to rest on it.

### PINE RIVER TO DUNVEGAN.

The valley of Peace River, from its junction with Pine River to Fort Dunvegan (about ninety miles), varies from half a mile to three miles in width at the level of the plateau, and from a quarter of a mile to two miles in the bottom; the river varies from 800 to 1,500 feet wide, and winds from side to side.

The banks are of the same character, many land slides occurring, though not so frequently as west of Pine River; and each stream which empties into the Peace has cut out a valley for itself hundreds of feet deep and of great width, so that the difficulties to be overcome in the construction of a railway can hardly be over-estimated.

We ascended to the level of the plateau at four points between Hudson's Hope and Dunvegan, and each time found it to be of the same general elevation, and extending in a nearly level plain as far as the eye could reach in each direction.

The slopes of the valley facing the south are everywhere covered with poplar copse and prairie, with good grass, and a small quantity of sage and cactus.

The slopes facing the north were invariably timbered with spruce and poplar, and the plateau, so far as seen from the edge of the valley, was generally covered by a similar forest, with only a very small proportion of prairie. The land appeared rich and well suited for agriculture; the timber, being small, could be cleared with a very small amount of labor.

### DUNVEGAN TO SMOKY RIVER.

We reached Fort Dunvegan on August 1st, and at once made arrangements with Mr. Kennedy, the officer in charge, to be supplied with pack-horses for our explorations till Mr. Dawson should arrive with our mule train. There was some difficulty and delay in finding the animals, so we did not get off till the 5th, and then only eight were available. Mr. Macleod and I took four each—a number so small as to preclude the possibility of riding—and travelled together in a south-easterly direction for three days, till we reached Smoky River, about forty-five miles.

The first four miles, while ascending to the plateau, were through timber, and the soil appeared cold and wet. Again, from about the twenty-first to the twenty-third mile, we passed over a low ridge timbered with poplar, spruce and willow, where the land was cold and wet.

The balance of the forty-five miles was through prairie and poplar copse, with a few willows in low places; the proportions were about one-third copse to two-thirds prairie, with grass twelve inches high, growing sufficiently close to form a sod.

The trail follows the more open parts of the country, and it is probable that the proportion of wooded land at some distance to either side would be greater.

The soil, with the exceptions above mentioned, is a grey silt, with a few inches of vegetable mould.

About twelve miles from Dunvegan we came upon Ghost Creek, twelve feet wide, a branch of the Brulè River, which we crossed at about nineteen miles; the latter is fifty feet wide, and empties into the Peace fifteen miles to the east of Dunvegan.

At the thirty-ninth mile we crossed the Bad Heart River, sixty feet wide, in a valley 250 feet deep, a quarter of a mile wide in the bottom, and nearly half a mile wide at the level of the plateau. From where we crossed, it flows in a north-east course for about five miles, and empties into Smoky River.

A straight line drawn from the forks of Pine River to Lesser Slave Lake would cross the Smoky River near this point, and we selected it as the most advantageous place to bridge that river, on a line of railway between these points, not only because of its proximity to the straight line, but because the valley of the Bad Heart affords an approach on the west side, while immediately opposite the Smoky River takes a bend of several miles nearly due east, giving an opportunity to approach it from the other side.

The works for about three miles on each side would be exceedingly heavy, continuing to be of a formidable character for several miles further.

Smoky River is here about 1,100 feet above sea level, 750 feet wide at high water, with a current of three miles per hour. To relieve the grades a bridge should be built about 100 feet in height; even then it is probable they could not be kept quite within a maximum of one per hundred.

Next day I parted company with Mr. MacLeod, he making a sweep round to the south-west on his way to Pine River, while I purposed travelling to Lesser Slave Lake in as direct a line as circumstances would admit, under the direction of an Indian guide, whom Mr. Kennedy had engaged for me at Dunvegan.

### SMOKY RIVER TO STURGEON LAKE.

We found a party of Crees and half-breeds hunting on Smoky River, who ferried us across in a canoe at a point about eight miles south of the Bad Heart.

The valley is there 450 feet deep and two miles wide at the level of the plateau.

The western bank has an irregular slope with many small hollows containing pools, caused by a series of land slides.

My guide kept travelling south-east and insisted he was taking the shortest route to Lesser Slave Lake, but after four days he brought us to Sturgeon Lake, five miles long by four broad, elevation above sea level about 1,900 feet; where there is a settlement of Crees.

I estimated that we had travelled during the four days only about forty-one miles. A very large proportion of the country is flooded by beaver, and we spent hours picking our way between ponds, wading across swamps, and bridging small streams with muddy banks in order to get our horses over. No streams of importance were crossed.

There are numerous swamp meadows, but very little if any true prairie; the timber is poplar, spruce, birch, willow and black pine (*pinus contorta*) all of small size, in a few cases nine to twelve inches, and two small groves of spruce nine to eighteen inches diameter were noticed.

The highest point passed over was about 2,100 feet above sea level, the country undulates gently, and if the beaver dams were cut away it could be drained with very little labour, the soil is white silt with four to six inches of vegetable mould.

The boulders and shingle on the beach of Sturgeon Lake were all granite and with them was a quantity of white quartzose sand.

### STURGEON LAKE TO LITTLE SMOKY RIVER.

It was very annoying to find that I had been led many miles out of my course and through swamps, to this lake, in order that my guide might have the pleasure of visiting some of his Indian friends; nevertheless such was the fact, and we had now to take a direction at right angles to our former one and travel north-eastwards towards Lesser Slave Lake.

About thirty miles brought us to Little Smoky River, 400 feet wide, in a valley 250 feet deep and one and a half miles broad, at the level of the plateau. The estimated elevation above sea level is 1,600 feet, depth two and a half feet, current four miles per hour.

Sturgeon Lake is one of the feeders of this river, but its principal source is in the range of mountains to the south of Lesser Slave Lake, and it discharges into the main Smoky, about fifteen miles below the mouth of the Bad Heart River, before referred to.

The beach and bars of this river consist of well rounded boulders and shingle of granite, with some large masses of sandstone, not much water-worn; also numerous pieces of lignite, but no rock was seen in beds, and there were no means of ascertaining from what distance they had drifted.

It is worth mentioning that a little before we reached this stream a stone about the size of my fist was met on the trail, and all the members of my little party stopped to examine it, not having seen one of any kind for days before.

### LITTLE SMOKY RIVER TO LESSER SLAVE LAKE.

Continuing the same course, at about seven miles we passed Iroquois Lake, one and a half miles long and three-quarters of a mile wide.

It discharges into Little Smoky River, being about 230 feet higher, and is separated only by a swamp from another lake of the same name, which empties into Lesser Slave Lake.

About seventeen miles from the Little Smoky, we crossed South Heart River, 60 feet wide, shallow, and with a current of two miles per hour, running in a valley a quarter of a mile wide and 60 feet deep.

Still continuing the same north-east course for about eleven miles, with the river not far to our right, we reached, August 19th, the western end of Lesser Slave Lake, into which it discharges.

The country from Sturgeon Lake to South Heart River is not so swampy or so much flooded by beaver as between Smoky River and that lake, but the timber and soil are precisely similar.

For one and a half miles after crossing South Heart River, we passed through a belt of black pine, on poor sandy soil, and then across a tamarac swamp half a mile in width; but from that point to the head of Lesser Slave Lake, our path lay along the face of a gentle slope facing the south-east, through a prairie of good grass, pea-vine and some small sage, with poplar and willow copse.

The soil is grey silt, with several inches of black vegetable mould.

### LESSER SLAVE LAKE.

We reached the western end of Lesser Slave Lake, 1,800 feet above sea level, on August 19th, and next day walked round the head of the lake, about seven miles, to the Hudson Bay Company's fort of the same name. Our path led us across Salt Creek, 50 feet wide, coming in from the north-west, which is bordered for a mile on each side by rich marsh meadows. They are subject to overflow in spring and during the early part of summer, but at the time of our visit they were nearly dry, and on many parts a mowing machine might have been used to advantage.

The grass is coarse in quality, but is said to be very nutritious, and a large quantity of hay per acre might be saved.

The western extremity of Lesser Slave Lake is a circular pond, about four miles in diameter, which is connected by a net work of channels about a mile in length, with another pond of nearly the same size, which in its turn is connected with the main lake by a channel about three miles in length. These ponds are quite shallow, seldom exceeding four feet in depth, and between them as well as to the south of them, marshes similar in every respect to that next Salt Creek stretch away for miles.

The fort stands just at the outlet of the first pond; the upland is there light and sandy, with a small growth of poplar, spruce, alder and willow.

A line of railway crossing the Smoky River at the mouth of the Bad Heart, as before described, should rise to the level of the plateau as rapidly as possible, and then, continuing eastward for some miles, descend gradually into the valley of Little Smoky River, cross it, and pass by way of Iroquois lakes to Lesser Slave Lake, following its southern shore to the east.

From the route which I had travelled, no hills were seen in the direction of Little Smoky River, and it is not likely that any serious difficulty would be met with on the line described.

### LESSER SLAVE LAKE TO PEACE RIVER.

At Lesser Slave Lake we were presented with a supply of white fish, weighing from three to four pounds each, similar in every respect to those found in the great North American lakes.

We left there August 21st, on our homeward journey, following the Hudson Bay Company's cart trail in a north-westerly direction towards Peace River.

About eleven miles from the lake we crossed the South Heart River, which was there 40 feet wide, coming from the north-east, and followed up some of its smaller tributaries to the twentieth mile.

Three miles farther we crossed a creek about 8 feet wide which flows into the North Heart River and followed the general direction of that stream to its confluence with the Peace, three miles below the mouth of Smoky River, and fifty-five from the western end of Lesser Slave Lake.

In the first five miles from the lake the trail ascends 400 feet and then descends gradually with many unimportant undulations towards Peace River, which is there about 900 feet above sea level, 1,300 feet wide, its immediate valley being 700 feet deep. We crossed a muskeg one mile wide, and travelled along the margin of another for half a mile, beside many small swamps which could be drained without difficulty, passing through one strip of prairie ten miles in length with rich soil and luxuriant grass and peavine, also some smaller prairies on slopes facing the south. The other portions of the road lay through groves of poplar and spruce, generally of small size, 3 to 12 inches in diameter, on soil of grey silt with 2 to 4 inches of vegetable mould.

### CROSSING OF PEACE RIVER TO DUNVEGAN.

At the mouth of the North Heart River the Hudson Bay Company have an extensive storehouse, from which are distributed the supplies, &c., destined for the Lower Peace River, and the posts far north on the Mackenzie.

Here we crossed the Peace, and continued our journey up its left bank on an open bench with poor gravelly soil, to the old trading post opposite Smoky River, established in 1792 by Sir Alexander Mackenzie, which has now been abandoned; and then ascending to the plateau by the cart trail, followed it to Dunvegan, nearly fifty miles in all.

The trail takes a moderately direct course, and is at one point about twelve miles distant from the valley of Peace River. It led us through a nearly level country, having an average elevation of 1,900 feet above sea level, with very rich soil, about one-fifth prairie and four-fifths poplar and willow copse, the timber being too small to be of value except for firewood and fencing.

Of the twenty miles next to Dunvegan, fifteen are in large open prairies, with rich grass, and such a depth of black vegetable mould that prodding with a stick to the depth of a foot we failed to reach the subsoil.

Between the Smoky River post and Dunvegan, forty-five miles, we crossed one running stream, the North Brulé, 10 feet wide, 12 inches deep, with a swift current, beside two small watercourses with stagnant pools, and we passed a lake one mile long by half a mile wide.

The supply of water is scanty, but the route of the trail seems to have been specially selected, with the view of passing between the heads of the streams draining south into Peace River direct, and those draining north into a river which joins the Peace a few miles below Smoky River.

In the whole trip from Dunvegan to Lesser Slave Lake and back, about 260 miles, solid rock was only seen once at the crossing of Peace River; very few boulders were noticed; and though some of the land is light, by far the greater proportion is rich, and will become a splendid farming country if the climate proves suitable.

### ARRANGEMENTS FOR HOMEWARD JOURNEY.

On my return to Dunvegan, August 28th, I found that Mr. Gordon had got back a few hours previously from an exploration to the north; that Mr. Dawson with the mule trains had arrived 12 days before and was then exploring Smoky River with a small party. He returned on the 30th, and Mr. Macleod, on September 1st, and all the members of our expedition were once more together.

By next afternoon we had agreed upon a short report to be forwarded to you by telegraph, and Mr. Gordon started eastward at once, carrying it with him to the nearest telegraph office.

Messrs. Macleod and Dawson had thoroughly examined the country south of the Peace from Pine River to Smoky River. It therefore seemed unnecessary that I should travel homeward over the same route which they followed, and so lose a good opportunity of gaining information of some of the vast tracts which were still unexplored.

I, therefore, determined to send Mr. G. R. Major with most of the men and mules by the direct route, instructing him to wait for me on Pine River, about 25 miles from the main forks, while I, with a small party, should travel on the north side of Peace River to Hudson's Hope; there cross over, follow the trail to Moberly's Lake and find my way as best I could to the party with Mr. Major.

At Lesser Slave Lake I had been much disappointed to learn that Mr. Tupper had not left Edmonton on August 2nd, so there was no hope of his party being available for forwarding my fellow travellers on their explorations to the southward and eastward; they had consequently to take four of the men who had come with us from British Columbia on with them.

They had also engaged two half-breeds at Dunvegan to go with them as far as Edmonton, and when we were all ready for a start, on September 5th, one of these turned out worthless and impertinent, and the party for Pine River, having left the day before, our only resource was to transfer to them the most reliable man of my little party, Wm. McNeil, from Victoria, an arrangment which left me rather short-handed.

This somewhat delayed my progress, and it was still further impeded by the fact that the Indian who undertook to guide me to Fort St. John did not know the country.

### DUNVEGAN TO FORT ST. JOHN.

From Dunvegan we travelled northward for a day and a half, say 30 miles, and then westward at an average distance of 15 miles from Peace River to Fort St. John, reaching it on the 12th.

For the whole distance, nearly 120 miles, the plateau undulates considerably, ranging from 1,900 to 2,400 feet above sea-level. And for 40 miles, after turning to the west, there was a range of hills a few miles to our right, rising from 600 to 1,500 feet above the adjacent country. My guide informed me that the streams on the other side of that ridge drained into the Battle and Liard Rivers.

Eleven streams, from 12 to 40 feet in width were crossed, besides numerous smaller ones, and Pine River North, which is situated about six miles from Fort St. John, and was then 100 feet wide by two feet deep, but at high water must be 300 feet wide, in a valley 700 feet deep and a quarter of a mile wide in the bottom. The slopes on both sides are much broken by old land slides.

On the west there is a bluff of decomposed shale, and on the face of the eastern slope many ledges of sandstone in nearly horizontal beds.

We saw a few small open muskegs, and had to cross one about one mile in width which delayed us more than four hours.

The soil is composed of white silt with a good covering of vegetable mould, but for one stretch of 14 miles, this has been completely burnt off. We also passed over two gravelly ridges.

A few large prairies were seen, and many small ones interspersed with poplar and willow copse.

Twenty-five per cent. of the distance, lay through woods of small poplar, spruce and black pine: near Pine River North, there was also a belt three miles wide of spruce six to fifteen inches in diameter.

### FORT ST. JOHN TO HUDSON'S HOPE.

My trip from Dunvegan to Fort St. John had occupied a longer time than had been anticipated, and the season was now so far advanced that I did not dare to linger on the road, but hurried on, keeping the trail to Hudson's Hope. Most of the way it followed the valley of the river and was on the plateau only for 12 miles after leaving Fort St. John, for about three miles near Middle River, half-way between the two places, and again for a short distance about six miles east of Hudson's Hope.

The soil is rich at each of these places, with prairie and poplar and willow copse, also a few small groves of poplar and spruce four to twelve inches in diameter.

On the benches next the river, the soil is in some places light, and between Middle River and Hudson's Hope, there is one stretch, six miles in length, gravelly and almost barren. That description of land also extends the whole way across the Rocky Mountain portage.

We crossed only one stream of importance, Middle River, which was then 4 feet deep by 150 feet wide, and at time of freshet 450 feet wide, besides three others from 12 to 25 feet across, with a few very small ones.

On the east side of Middle River and about fifteen miles North of the Peace, a range of hills 1,000 or 1,500 feet high was observed running nearly east and west.

Fires were raging in the bush in many places, and we had to ride through one belt of woods burning briskly at the time, which we did with difficulty as the smoke and ashes were blinding, and the heat was very great; fortunately, the timber was fairly open or we should have been stopped.

Regarding the country north of Peace River, I noticed that from the eastern base of the Rocky Mountains, about twenty miles north of Hudson's Hope, a range of hills extends, nearly due east till it meets the Peace River, about twelve miles below its junction with Smoky River.

The tract of country lying south of that range, and between it and the Peace, is generally fertile, but that portion of it west of the longitude of Dunvegan is more undulating and at a slightly higher elevation than the other portions of the plateau in the Peace River district, which I had travelled over, and has an appreciable per centage of poor soil.

### HUDSON'S HOPE TO PINE RIVER.

We reached Hudson's Hope September 15th, and tried to obtain a guide to take us to Pine River, but failed, as the Indians were all absent; accordingly we left next morning and followed a hunting trail to Moberly's Lake. This trail ascends from Peace River by a series of benches, and at one and a-half miles reaches the plateau, which is there about 2,000 feet above sea level, and continues at the same elevation to the fifth mile; it then passes over a ridge 900 feet above the plateau and along a steep hill side to the south-western end of Moberly's Lake, at an estimated elevation of 2,050 feet above sea level

According to the best sources of information at my disposal, Moberly's Lake should have been situated two-thirds of the way across from the Peace to Pine River, and in a country fitted for settlement, though somewhat hilly and with large areas of prairie land.

Great was my surprise, therefore, to find myself only nine miles from Hudson's Hope, and hemmed in by hills, rising from 3,000 to 4,500 feet above sea level, the only level land visible, being in the valley of Moberly's River which empties into the lake from the west; and further, that between me and Pine River lay a range of mountains at least sixteen miles broad, rendered almost impassable by fallen timber, the only prairies being on the slopes of steep hills facing the south.

There was no possibility of retreat: the party on Pine River was waiting for us; and, having only a limited quantity of provisions, delay might prove disastrous to both parties.

Fortunately, I was able to reinforce my little band by engaging the services of an Irishman named Armstrong, whom we found building a shanty for himself in order to hunt during the winter; he had spent part of the summer at the lake, hunting, prospecting for gold, and catching fish for the support of a number of sleigh dogs belonging to the Hudson Bay Company.

White fish were then, September 17th, very abundant, and he gave us all we could carry. They varied from 4 to 6 lbs. in weight, were very fat and seemed to me quite equal to the far-famed white fish of Lake Huron.

We followed the valley of Moberly's River, south-westwards, for eight miles and then turned southwards up a small tributary. After four days, during which we had chopped our way through fallen timber from day-light to dark, I found myself in a small basin with hills rising steeply 1,000 to 1,200 feet on both sides and in front, and these, where not actually precipitous, were so strewn with fallen timber of large size, that it seemed a hopeless task to attempt to cut our way through without help. I therefore sent two men ahead to find Mr. Major and get some of his party to come to our assistance, while I remained behind to take care of the mules, assisted by Armstrong, who had cut his foot with an axe.

My messengers returned three days afterwards with six men, and on September 24th we reached Pine River and joined the main party.

I estimated that we were then only seventeen miles from Moberly's Lake, but had travelled nearly thirty, and in the last four miles had passed over a mountain 4,200 feet above sea-level. We were also about twenty miles west of the point where I expected to find myself.

In the first five miles from Hudson Hope we had crossed two small tamarac swamps and some stretches of light, sandy soil, with a small growth of poplar and spruce.

We had again met with some level land in the valley of Moberly's River, which for nine miles above the lake averages nearly half a mile in width in the bottom. Some portions of this are gravelly and barren, and others fertile, with a few small prairies producing rich grass. There are also some fine prairies at the lake, on slopes facing the south.

Between Moberly's Lake and Pine River there is now a young growth of spruce, black pine and poplar, but the piles of fallen timber proved the existence not long ago of spruce forests of moderate size, and a few belts of that timber, 6 in. to 24 in. diameter, having escaped the ravages of fire, are still standing.

### PINE RIVER TO THE SUMMIT OF THE PASS.

The general characteristics of the country, from this point westward to Stewart Lake, have been fully described by Mr. Hunter in your report of 1878 (Appendix G); and as I am prepared to endorse that description, it seems unnecessary for me to touch on any but the more salient features, as seen from an engineering point of view, in connection with railway construction.

The valley of Pine River, where I entered it, is half a mile wide, from the base of one hill to that of the other; and in its westward course continues of the same size for eighteen miles; it then narrows to a quarter of a mile, and remains so, with a few trifling exceptions, all the way to the summit, about seventeen miles farther.

At a few points, where the river washes the base of the mountains, expensive works of protection might be required, and heavy excavations in getting from one bench to another, when they differ much in elevation.

One mile east of the summit there is a precipice 180 feet in height, reaching right across the valley, and below it for many miles Pine River falls about thirty feet per mile, so that to gain the summit with grades of one per hundred, there would require to be over seven miles of side-hill work, principally in rock, and very heavy. These hills are, however, thickly timbered, and no fears need be entertained in regard to avalanches.

The other portions of this section offer no serious obstructions to railway construction.

### PINE RIVER PASS TO FORT MACLEOD.

Just at the summit, which we ascertained to be about 2,800 feet above sea level, there is an open space which shows indications of the annual deposit of large quantities of snow, which slide each winter from the mountain on the south eastern side of the pass.

This feature would entail the construction of a tunnel in rock about 1,200 feet in length.

Proceeding westward, Azuzetta Lake discharges its waters by a small stream, the Atenatche, which descends 300 feet in two miles to the Misinchinca, and that river, below the point of junction, has a fall of more than twenty-five feet per mile.

To keep the grades on this section within a maximum of one per hundred would require much sharp curvature and excessively heavy work.

The valley of the Atenatche is a mere gorge; and immediately below its mouth, on the northern bank of the Misinchinca, there is a high gravel slide, followed by rough and rocky slopes, which extend for six or seven miles down the river, rendering the building of a line along their face very expensive.

Further to the westward, the descent is gradual, and the valley sufficiently wide to admit of railway construction without much difficulty.

At the junction of the Misinchinca and Parsnip rivers, the latter is 500 feet wide and about eight feet deep; half a mile higher up our mules forded it October 1st, in three feet of water.

On the west side there is a gravel bench 120 feet above the water, which continues on the same level for two miles to the westward, and then descends gradually to Tutia Lake.

The crossing of the Parsnip would require a high bridge and a heavy cutting on the west side. There would also be some heavy work in descending along the face of the hills on the eastern shore of Tutia Lake, so as to cross the Pack River between that lake and Fort McLeod.

There are probably several routes by which a line coming westward through the Pine River Pass could be carried to Port Simpson, on the Pacific coast; but the only one which I have personally examined throughout is that *vià* Fraser Lake, the Watsonquah and Skeena Rivers. I shall therefore confine my description to that one only.

### FORT MCLEOD TO STEWART RIVER.

The section of country between the Pack River and the Stewart is not favorable for railway construction; it has been well described by Mr. Hunter as being broken up by sandy and gravelly ridges, low, boggy flats and depressions containing stagnant pools, with small lakes and sluggish streams. The timber is of little value, being generally black pine, spruce and balsam of small size.

No doubt a line of railway could be constructed between the two rivers, and in the neighborhood of the trail from Fort McLeod to Fort St. James.

In leaving the former place it ascends nearly 700 feet in twelve miles; the grade, however, could be somewhat eased by crossing the Pack River, 150 feet wide, four or five miles below the fort and ascending along the side of the hills facing on that river and the Long Lake River. Continuing eastward, with some heavy indulations at the crossing of Salmon and Swamp Rivers, it would have to descend about 500 feet in twelve miles to the Stewart River.

The general course of such a line would be moderately direct. It would, however, require many local windings, and the works would be heavy near both ends, though principally in gravel.

### STEWART RIVER TO FRASER LAKE.

To continue the line westwards, the Stewart River, 600 feet wide, should be crossed several miles below Fort St. James. Then making a bend to the south in order to ascend with moderate grades, 600 feet, to the summit of the ridge between it and the Nechacoh, the road could be carried along the northern slopes of the valley of that river to Fraser Lake, and in so far as one could form an opinion by looking at the slopes referred to from a distance of eight or nine miles, without serious difficulty in regard to grades, curves or works of construction.

In your report for 1878, Appendix C, I have already expressed the opinion that a line from Fraser Lake by Intaquah and Watsonquah Rivers to the Skeena would have easy grades and moderate works, and nothing has since occurred to cause me to alter that statement.

### WINTRY WEATHER.

When we reached the summit of Pine River Pass, on Saturday, September 27th the weather was lovely, and only one small patch of snow was to be seen on the northern side of one of the higher peaks.

Next morning, at 4 a.m., I found that the barometer was going down, that heavy rain was falling in the valley, and snow on the mountain sides, so I called up the camp at once, and pushing on with all speed, travelled as many hours per day as the mules could stand.

We did not relax our efforts till the settlements were reached, where feed could be purchased and the train might be considerd safe.

During September 28th the rain changed to snow, even in the valley; and alternating with hail and sleet, it fell on thirteen out of the following twenty-two days.

Had we been a week later or even less in reaching the pass, I feel convinced that the mules would all have perished and we ourselves might have experienced many hardships.

When we reached the Nechacoh river, they were so leg weary and weakened by want of food (for the grasses in that northern country do not retain their succulent qualities when frozen, as the bunch grass of southern British Columbia does), that I determined to lighten them and taking everything which could be spared with me in a boat belonging to the Hudson Bay Company, followed that river to Fort George, and thence by the Fraser River to Quesnel Mouth, which place I reached on October 17th, and at once hired two horses, loaded them with grain and sent them out to meet the train.

This was a great assistance to the weaker ones, and all got to Quesnel in safety, though one died three days afterwards when on the road to their winter quarters at Kamloops. During the season we had moved camp one hundred and one times.

## CLIMATE.

Climate is a subject on which it is difficult to form correct conclusions from the experience of one season. And the summer of 1879 having been an exceptionally cold and wet one renders it more than usually so.

The following statement of the crops, etc., seen at the various Hudson Bay posts throws a little light on the matter.

At Fort St. James, July 5th—8th we found most kinds of garden vegetables and barley, all looking well. On October 8th, there was snow on the hills and adjacent country, but none near the shores of Stewart Lake, the people at the fort were busy digging potatoes, other vegetables and grain having been housed sometime previously. A small herd of cattle and horses are kept here, hay for their sustenance during the winter being cut in some of the natural meadows.

Fort Macleod, July 14th—16th. Here we saw some sickly-looking potatoes, the vines of which had been frozen to the ground in June. A fine crop of peas and carrots, with a few miserable onions.

The soil of the garden is light and probably had not been manured for a great many years. The latitude is only half a degree farther north than Fort St. James, and the elevation 300 feet less, which should nearly compensate for the difference in latitude, but the climate seems colder, more damp, and less suited for agriculture, owing probably to its closer proximity to the Rocky Mountains. On October 2nd, all the vegetables were housed and three inches of wet snow lay on the ground.

Hudson's Hope, July 27th—29th. The soil in the garden is a good sandy loam, and onions were very fine; all other crops had been injured by a severe frost about May 15th, beans were killed, so were the potatoe vines, but they had started afresh. A little patch of wheat had been frozen, but had grown up again, and a few stalks were forming ears; carrots and cabbage looked well. It was said that the frost in May was confined to the valley, and did not extend to the plateau.

Horses have wintered in the open air for many years, but in the winter of 1875-6 twenty out of a band of twenty-four perished on account of the deep snow.

Returning there, September 14th–16th, we found the potatoes had produced only a very poor crop, and the wheat had been again frozen, while the grain was in the milk stage, rendering it useless.

Fort St. John, July 30th. The garden contained some good potatoes, onions and turnips, and a negro named Daniel Williams had a small patch of excellent barley. On September 12th, the crops were all ripe, and excellent both as regards quantity and quality, but the barley had been trodden down by animals and much of it eaten, the owner having been arrested and taken to Edmonton on some criminal charge.

Fort Dunvegan, August 1st-5th. In the garden of the fort there were fine crops of wheat, barley, potatoes, beets, cucumbers and squash; while at the R. C. Mission close by, there were fine potatoes, onions, carrots, and a luxuriant but very backward crop of wheat, a condition of things which Mr. Tessier, the priest, explained to us had resulted from a long drought, causing to lie in the ground without sprouting the grain till some heavy rain occurred at the end of May. From August 28th, to September 5th, the wheat at the fort was cut, but the grain was not perfectly ripe; that at the Mission, was injured by frost and there was no hope of its ripening, other crops had succeeded well.

Lesser Slave Lake, August 20th. In the garden of the fort were peas, beans, turnips, carrots, potatoes and rhubarb, all looking well. And in the garden at the R. C. Mission were the same vegetables, also onions, cabbages, barley (good) with some very fine wheat almost ripe and quite beyond the reach of any frost likely to occur at that season. The success of these crops at an altitude of 1,800 feet above the sea, and therefore nearly on the general level of the plateau, east of the Rocky Mountains, is a matter of some importance, though the proximity of the lake may have influenced the temperature.

The gardens at Hudson's Hope, Fort St. John, and Dunvegan, are in the valley of Peace River, many hundred feet below that level, and they have also the advantage of a great deal of heat, reflected from the adjacent hills. In this connection it is right to mention that all the seed used by the people in the Peace River district has been grown year after year in the same ground, and generally without manure, also that they have not the most improved and earliest varieties of either grain or vegetables.

Eastward of Hudson's Hope it is said that snow seldom lies to a greater depth than two feet, and horses winter in the open air; when it attains that thickness, however, they resort to the slopes of the valley facing the south, where the snow drifts off, leaving the grass bare.

We had been in the valley of Peace River, from the mountains to Dunvegan, in the latter part of July, and the weather was then warm and mild.

The month of August was spent between Dunvegan and Lesser Slave Lake, and twenty-three days of it on the plateau.

During that time there was frost on the morning of the 6th, though the thermometer at 5 a.m. had risen to 46°.

Again, on the 26th, when it was still 5° below the freezing point at 5 a.m., and on the 27th when it had risen to 33° at 4.30 a.m.

On the other twenty days the lowest reading, between 4.30 and 5 a.m., was 39° and the highest 65°. The weather was clear and fine and in the afternoon, it was often warm enough to send the thermometer up to 80° in the shade.

From the time of leaving Dunvegan, September 5th, till we passed Moberly's Lake, on the 16th, we were on the level of the plateau, and might still be considered east of the mountains. There was frost on eight nights out of the twelve.

While breakfasting at 5 a.m. on the 9th, the thermometer still stood at 20°, and on three other mornings it had not risen above the freezing point at that hour. During that time the weather was generally clear and bright.

We had fine but cold weather from the 17th till the summit of Pine River Pass was crossed on 28th and from that time till we reached Quesnel on October 17th, it was decidedly wintry, with hard frosts.

## GENERAL RESULTS.

As the result of the season's explorations, the following conclusions may be arrived at: that a northern route for a railway can be found from Port Simpson *viâ* the Rivers Skeena, Babine, Driftwood, Omenica and Finlay to the Peace River Pass.; and that some other, though more circuitous routes are available by which the same pass could be reached.

The Peace River which is the lowest known pass through the Rocky Mountains offers a wonderfully favorable line for a railway through that range, and for sixty miles east of its main summits.

Beyond that point, the Rocky Mountain Canon, extensive land slides, and lateral valleys of great depth render the construction of a line of railway immediately along the sides of the river very difficult, if not impracticable.

There are, however, grounds for the belief that an available line may be secured by leaving the actual valley near the head of the canon, and passing to the south of it, and by the northern end of Moberley's Lake, crossing Pine River, a few miles north of the main fork, and continuing eastward to Lesser Slave Lake, or to Edmonton, by some of the routes explored this year.

The Pine River Pass is also a remarkable one, and though the elevation is much greater than that by the Peace River, the works in passing through the mountain range would be lighter. A favorable line can be found from the valley of the Skeena *viâ* the Watsonquah River, Fraser Lake and Fort McLeod to connect with this pass, but such a line would be very circuitous and many miles longer than the northern one.

Without taking into consideration the ground gone over by the other members of our expedition when we separated, I can state that there is a tract of great fertility extending eastward from the foot hills of the Rocky Mountains at Hudson's Hope to Lesser Slave Lake.

Messrs. McLeod and Dawson have examined it south-westwards to the base of the Rocky Mountains, and will inform you of its precise extent in that direction. How far it reaches to the north is still undetermined, but I saw, and can speak from personal observation of the strip just referred to, two hundred miles long by fifty wide, which, if the climate proves suitable, can hardly be surpassed as an agricultural district.

On the last point I have furnished you with all the information at my disposal, and my own impression is that this country will be found well suited for stock raising, cattle being housed in winter, for the growth of all kinds of vegetables, and the hardier cereals and probably of wheat, provided that varieties are used which come to maturity before the frosts in early autumn. No doubt partial failures will occasionally occur, but that has been the case during the past year in many parts of the northern hemisphere, which are usually most productive.

In conclusion I beg to state that all our packers, boatmen and other assistants worked with a will and helped us as far as lay in their power.

To the officers of the Hudson Bay Company, generally, we are much indebted for assistance.

Our thanks are especially due to Mr. Alexander, of Fort St. James, the Superintendent of New Caledonia District, and Mr. Kennedy, of Dunvegan, who spared no trouble to furnish us with guides, with boats and with horses.

I have the honor to be, Sir,

Your obedient servant,

H. J. CAMBIE.

SANDFORD FLEMING, Esq., C.M.G.,
Engineer-in-Chief, Canadian Pacific Railway,
Ottawa.

# APPENDIX No. 3.

## REPORT ON EXPLORATIONS MADE BETWEEN PORT SIMPSON B. C., AND BATTLEFORD N.-W. T. VIA THE VALLEY OF PEACE RIVER, DURING THE SEASON OF 1879, BY HENRY A. F. MACLEOD.

OTTAWA, 7th February, 1880.

SIR,—I have the honor to report that I made an exploration of the country lying between Port Simpson, B.C., and Edmonton N.-W.T., by way of Peace River, in accordance with your instructions dated 12th and 13th May, 1879.

I was directed to co-operate with Mr. Cambie in the examinations from Port Simpson to Slave Lake, and with Dr. G. M. Dawson of the Geological Survey, from Pine River to Edmonton and Lac La Biche. Mr. R. L. Tupper was directed to proceed vià Winnipeg to Edmonton, thence across the country following approximately a given direction to Dunvegan on Peace River, at which place it was expected that all the parties would arrive about the same time.

The main object of the exploration was to determine how far it was feasible to construct the railway passing through the Pine River or Peace River Passes in the direction of Lac La Biche or Edmonton, and to ascertain the approximate distances to enable a comparison to be made with the routes already surveyed via Yellow Head Pass.

At the same time it was required to make a general examination of the Harbor of Port Simpson, of Work Inlet, and the approaches to them from the Skeena River, also an exploration from the mouth of the Skeena to the Forks, and thence via Fort St. James through the Pine and Peace River Passes.

The capabilities of the country, in an agricultural point of view, along the proposed routes were to be noted, particularly in the Peace River country.

The party left Toronto on the 13th May, arrived at San Francisco on the 19th, and at Victoria on the 24th.

It being necessary to wait here some days to make arrangements, I crossed to see Burrard Inlet. I also ascended the Fraser to Yale, and drove over the waggon road to Boston Bar, so as to enable me to form a comparison between that route and the one proposed up the valley of the Skeena.

Having made final arrangements for forwarding supplies by trail to Fort St. James to meet us, we sailed on the 3rd June for Port Simpson, arriving there on the 6th. In passing Metlahkatlah, we engaged Indians and canoes for the journey up the Skeena.

### PORT SIMPSON.

The steamer, drawing 10 feet, entered the harbor of Port Simpson at low tide by the southern entrance, after waiting for an hour she passed out by the northern entrance. The main entrance is from the west between Birnie Island and extensive reefs lying to the south about a mile distant, many of these reefs are uncovered at low tide and form a good breakwater to the western sea.

The harbor is good, and is sheltered from the S.W. round by south to the N.W. Westerly winds would sweep with considerable force across the harbor, but would not be accompanied by much sea. Captain Lewis of the Hudson's Bay Co., who lived there for some time and has had long experience on the coast, considers it a very fine harbour he says the most prevalent gales are from the S.E. in summer and from the N.E. in winter. The ground is not high around the shores and is sufficiently even for the site of a large town.

The approach from the ocean is good, the rocks known as the Pointers are rather to the south of the track taken by vessels from the ocean, and can be utilized as sites for light-houses, no soundings being obtainable except within a short distance of the entrance to the harbour.

On leaving Port Simpson we sailed to the entrance and up to the head of Wark Inlet. The mouth of the inlet is narrow and deep, and the current with ebb tide was about four miles an hour. The width increases inside from one to two miles, and the depth of water is considerable; near the entrance the sounding was 28 fathoms, thence to within three-fourths of a mile of the head no bottom was found at 76 fathoms, at 500 feet from the shore the depth is 25 fathoms, so that we found no part of the inlet suitable for anchorage.

About three miles from the entrance there is a low pass to Port Simpson between the hills—thence, going south-easterly there are benches near the shore line, which disappear, and are succeeded by side hills, getting steeper as the head of the inlet is reached. In this latter portion five small tree-slides were noticed, 50 to 200 feet wide, extending from 200 to 400 feet up the hill side.

There is hardly any level land at the head of Wark Inlet, but there is probably a length of a mile where wharves can be built to advantage.

The pass from the head of the inlet to the Skeena River, running in a south-easterly direction, does not appear to be high.

From Wark Inlet we returned by steamer to Port Essington, and commenced the ascent of the Skeena on the 7th of June. The strong currents with each tide, and the ice from the Skeena and Exstall Inlet, will interfere with the anchorage here at certain seasons.

## SKEENA RIVER.

Looking at the pass from the Skeena towards Wark Inlet, about nine miles from Port Essington, the valley is wide with even slopes for a considerable distance, and following up the main valley of the Skeena, the slopes are of the same character, and there are frequently even benches extending about six miles along the north shore. In the next four miles the hills become steeper, and the mountains are nearer the shore, but the water at the foot and for some distance from the shore line is shallow. A tree-slide about 500 feet wide, extending 800 feet up the hill was noted in this part of the valley.

In the next mile the slopes are very bold, rising directly from the water, at about one in three-quarters. The rocks are in many places quite bare and polished, and there is a heavy snow-slide down a clift in the rocks about 100 feet wide.

The water at the base, however, is shoal, and there is space abundant to admit of encroachment on the tide way. In this respect the construction of the railway in this valley would have a great advantage over that in the valley of the Fraser.

Continuing the ascent of the river, for about ten miles, the head of the tide is reached, about 30 miles from Port Essington. In this interval there are on the north shore eight bold points of rock approaching the water, with intervening valleys, and small flats and islands separated by small sloughs. The water is shoal in front of these points, except in one or two cases. There are also eight snow-slides, three of which will have to be guarded against.

Throughout the following six miles there are seven rock points, two of which are heavy with deep water in front and strong current; also five snow-slides, one of which will require attention. For the rest of the distance, there are small benches and valleys, with islands and small sloughs.

In the course of the 11 miles following, the valley assumes a more even character and the hills become more thickly covered with woods to the top. The benches at the foot of the hills are more frequent and continuous. Only two rock points approach the water, one of them will probably require a short tunnel. Five snow-slides occur, one of which will require particular attention. At the mouth of the Kstume River a bay six feet deep and 800 feet wide must be crossed, having a bridge of 100 feet opening.

The valley continues to widen out on the next ten miles, and the flats are wider and more extensive. About one-fourth the distance heavy side hills and hollows. No snow-slides come near the water. The current of the river is swifter, and the ascents more difficult. The Kstoow River will require an opening of 30 feet.

The work on the following 18 miles would be moderately light on bench, flats and islands separated by small sloughs. At seven points of rock and side hill, there will be about two and a half miles of heavy work. The Simaguan and Kitsumgallum Rivers will require about 400 feet of bridging. The Mumford Landing, at the head of Simselas Canyon, is near this point.

On the next 11 miles the work is generally moderately light on benches, flats and islands with narrow sloughs. At the Ksipkeeagh Falls, which are about five feet high, there will be heavy work in following round a deep narrow bay. Also at two rocky points and bays near the mouth of the Zymoets River, in all about one and a half miles of heavy work. The river is very rapid, and the banks and benches of gravel towards the upper end are 70 feet high.

In the course of the six miles following the work is moderately heavy, particularly at the Kitsalas Canyon and some distance on each side of it, or about two miles of heavy work. The sides of the canyon are perpendicular, and about 70 feet high and 300 feet apart. There are two portages, and the water falls about 15 feet. For the rest of the distance there are flats and benches from 10 to 70 feet above the river which here is about 800 feet wide.

The mountains recede from the river in the following nine miles, with small detached hills in front, behind which the line can be located to advantage in several places. The height of the mountains near the river are from 1 to 2,000 feet. The work on this portion will be moderately light on flats, and gravelly benches, except in ascending to some high benches, and in passing two rocky points and a rocky side hill, in all about one mile of heavy work. There are four streams requiring bridges from 30 to 50 feet and one 200 feet.

The work on the succeeding 11 miles will be generally moderately light. At seven points the work will be heavy, in passing rocky points and side hills, in all about two miles. At Quatsallix Canyon the rocks are 200 feet high, but the line may be perhaps behind the knolls and save a mile of heavy work. There are three large streams, requiring from 100 to 300 feet bridges each, one of them opposite Keaval Bluff is from a glacier in view, four miles distant. There are also three small streams.

In the next 19 miles to Kitwungan Village, the valley widens out, and the country improves in appearance—there are some good flats with grass and pea vine—heavy work will occur in about 10 places, where there are rock points, side hills, and clay bluff, also in changing from low flats to high terraces, and at the crossings of four streams, in all about six miles. Two streams will require bridges of 100 and 200 feet each, and three of 50 feet each. The main river continues very swift, with strong rapids.

The banks of the river for 11 miles following are rough and broken, with points of rocks, side hills and bold bluffs of clay and gravel, alternating with narrow flats and benches from 20 to 100 feet above the river. A line may possibly be found, keeping about four miles back from the river, otherwise there will be about six miles of heavy rock and clay work, particularly in the vicinity of Kitsiguele Canyon, for the rest of the distance work would be moderately light. At one point in the canyon the river is about 400 feet wide, but generally the width is 800 feet. The current is very swift and rapid.

In the next eight miles to the Forks, or Hazleton Village, the valley widens out, and there are some flats with grass and pea vine. The banks are of clay and gravel from 60 to 70 feet high, and there are two clay bluffs, which require about a mile of heavy work, the rest moderately light. The line will, however, be some miles back from the river, as it will be necessary to follow the Skeena River which bends to the north to the mouth of the Babine River 38½ miles, unless the route by the telegraph trail is adopted. There are two streams in this distance, requiring 50 feet of bridging each.

### FORKS OF THE SKEENA TO LAKE BABINE.

The trail followed from the Forks of the Skeena to Babine Lake, passes up the north side of the valley of the Watsonquah River, then the Susqua, and lastly, the Ouatsanlee to the summit. All these streams are tributaries to the Skeena. It then descends rapidly to the foot of Babine Lake, crossing a large stream from a lake, which discharges itswaters both easterly and westerly at the summit.

The character of the country is rough and mountainous, unfit for railway construction, with deep tranverse valleys in many places.

The distance from the Forks to the summit is about 35 miles, thence to Lake Babine seven miles, and the watershed 750 feet below the trail summit is 3,250 feet above the Forks, and 1,450 feet above Lake Babine. There is some fair soil on the plateaux about the Forks and at Lake Babine, and some good pasturage in the valleys.

### BABINE LAKE TO FORT ST. JAMES.

The journey to Fort St. James from this point, was by canoe to the head of Babine Lake about 100 miles, thence by portage over a waggon road to Stewart Lake eight and a half miles, and thence by boat to Fort St. James, at the foot of Stewart Lake, 39 miles.

The banks of the northern part of Babine Lake are generally low, from 50 to 200 feet, rising gently to hills in the rear from 400 to 2,000 feet above the lake. As the bay at Fort Babine runs inland about 10 miles, it will be necessary for the railway to leave the Babine River some miles below the foot of the lake, and follow a valley leading to the head of the bay above mentioned.

This valley runs parallel to the lake, and the watershed in it is about 400 feet higher than the lake. On the south side of the bay and opposite to Fort Babine is a pass, leading to Tatla Lake, the summit of which is about 970 feet above Lake Babine. The approach to this pass from the valley, along the side hill, does not appear to be very difficult. It is probable that a practicable line may be found from Tatla Lake to the Nation River. We were informed that boats have been taken through the pass.

On leaving Fort Babine we were compelled, by numerous islands and deep bays, to keep at a distance of from one to five miles from the easterly shore. There did not seem to be much difficulty in continuing the line near the shore for about 30 miles to the south of Fort Babine. At this point there is a low pass to Trembleur or Cross Lake. About 14 miles south of Fort Babine there is another place where the hills are low. To the south of the pass to Trembleur Lake, the banks of Babine Lake become high, and the hills along the eastern reach, at the south of the lake, are bold and high, rising directly from the water.

The road between Babine and Stewart Lakes passes over the watershed between the Skeena and Fraser Rivers, at a height of about 390 feet above Lake Babine, with high ground north and south. Stewart Lake is about 30 feet lower than Babine. The Yekooche, a stream of considerable size, flows into the head of Stewart Lake from the west through a wide valley with high hills on each side.

The hills at each end of Stewart Lake are high and bold, towards the centre near the outlet of Taché River the ground is more even. Near the west end there is a bay about 14 miles long, running in to the north-west, surrounded by high hills. The head of this bay is about 4 miles from Trembleur Lake.

From the foot of Lake Babine to Fort Babine the hill sides appear to be suitable for grazing, also at each end of the road between the lakes. There are some flats about the mouth of Taché River, and around Tescar Lake and River, which may prove to be suitable for agriculture.

### STEWART LAKE TO MACLEOD'S LAKE.

At Fort St. James, Stewart Lake, on the 5th of July, we met the pack trains ordered from Kamloops, and with them we made the journey by trail to McLeod's Lake, about 68 miles

This route would form part of the line from the Skeena via the telegraph trail to the Pine Pass.

The trail follows the valley of Saw Mill Creek for about 9 miles, then passes over a low watershed to a stream running to Tescar Lake, west of Fort St. James, at 9½ miles. In this distance the ascent from Stewart Lake is about 350 feet. The ground is even and undulating.

In the next 17 miles to Salmon River the country is undulating and hilly. Up to Carrier Lake the undulations are small and the streams flow northward. The trail then crosses the watershed of Salmon River ascending about 350 feet above Carrier Lake, it then descends about 250 to Salmon River. On this latter portion the undulations are from 60 to 100 feet.

The trail follows Salmon River for 2 miles, and then crosses to a tributary stream of the same river, keeping in this valley to the watershed of Swamp River. It then descends to Swamp River, distance in all 10 miles. This portion is hilly and undulating, rising about 340 feet to the watershed, and descending about 90 to Swamp River. The undulations are from 100 to 200 feet.

From Swamp River to Carp Lake, about 11 miles, the country is even and level, passing over the watershed between the Pacific and Arctic waters 80 feet above Swamp River, and falling 140 feet to Carp Lake.

For the rest of the distance to McLeod's Lake, 21 miles, the line will follow the shores of Carp Lake, Long Lake and the valley of Long Lake River. The banks of the lakes are hilly and undulating, and the valley of Long Lake River broken and hilly, with deep tranverse valleys. The descent from Long Lake to McLeod's Lake is about 530 feet in 12½ miles.

The heaviest work between Fort St. James and McLeod's Lake will be in the valley of Long Lake River, principally in heavy gravel hills. The grades will be long and steep. From Carrier Lake to Swamp River the work and grades will be heavy. For the rest of the distance, moderately light.

There is some fair soil about Fort St. James which will probably be found suitable for agriculture, but the rest of the country is barren, sandy and gravelly soil, with a small growth of poplar and spruce.

The watercourses on this section are generally small. Salmon River will require a bridge of 60 feet, and Swamp River 30 feet; other streams from 10 to 20 feet openings.

### MCLEOD'S LAKE TO DUNVEGAN.

Between McLeod's Lake and Dunvegan, the party divided, Dr. Dawson with the pack trains going by Pine Pass, and the rest of the party by boat, down the Parsnip and Peace River to the portage, and by raft to Dunvegan.

On the 17th July we descended Pack River, and on the 18th and 19th ascended the Parsnip, to the mouth of the Missinchinca River, where we ferried Dr. Dawson and the cargoes across the Parsnip.

The most suitable crossing of Pack River will be near the head of Trout Lake, and will require a bridge about 300 feet long. Thence to near the crossing of the Parsnip above the Missinchinca, the construction will not be difficult. The approach to the Parsnip will be heavy on the west side; the bank is 120 feet high, and continues high for two miles down the river. The water-way required will be about 500 feet.

Should it be necessary to bring the line down Pack River there would not be much difficulty in doing so, as the banks are generally low, from 10 to 30 feet, and there are many flats. On the left bank, near the Parsnip River, the banks are steep, and rise from 100 to 200 feet. There are several places where the line could easily cross Pack River below Trout Lake. The distance from McLeod's Lake to the Parsnip is about 18 miles.

From the mouth of the Missinchinca River to the Nation River, a distance of 41 miles, the ground on the east side of the Parsnip River is well suited for railway construction, consisting principally of extensive flats along the base of the foothills, to within four miles of the Nation River.

In this portion at seven places, banks from 50 to 100 feet high approach the river, causing about three miles of heavy work.

At four miles above the Nation River there is a good crossing with rock banks. The water is, however, deep and rapid. The length of the bridge would be 300 feet.

From this point to a flat half a mile from the Nation, the banks are generally close to the river and are from 60 to 100 feet high, with terraces above. On ascending the east bank of the Parsnip we had a good view up the valley of the Nation. The mountains appeared to be about 10 miles distant, and the lower part of the valley was composed of terraces 50 to 200 feet high. On the east side of the Parsnip the mountains are about 8 miles distant.

From the Nation to Finlay River, 39 miles, there are extensive flats on each side of the Parsnip, alternating with bold banks of clay and gravel, with rock occasionally near the water. The banks rise to a height of from 100 to 200 feet, and in a few places are not stable. The Finlay River is about 300 feet wide, and at the forks where the river becomes the Peace River, it is about 500 feet wide, deep and swift.

The Peace River passes through the main chain of the Rocky Mountains between Finlay River and Clear Water River, in a distance of about 25 miles. There are flats and benches with occasional bluffs of clay and gravel for nine miles to Wicked River. Thence to Clear Water River the mountains approach close to the river, but even here there are narrow flats and benches alternating with bluffs of clay, gravel and rock; some of the clay banks sliding, also two snow-slides, causing heavy work for a distance of about six miles.

The width of the river is from 500 to 800 feet, and from top to top of the mountains three to four miles.

The scenery, in passing through this gorge, is magnificent.

Wicked River and Clear Water River would require a water-way of 100 feet each. There are also some smaller streams from 20 to 40 feet wide.

In the next 41 miles to the Rocky Mountain Portage the mountains recede from the river. The hills on the north side are covered with grass, and are wooded on the south.

There are extensive flats and benches on this portion of Peace River, particularly towards the Portage, and in the neighborhood of the Otter Tail River, Eight-Mile Creek, and other lateral streams. There are also some bold bluffs of clay and gravel, sliding in a few places, and small exposures of rock close to the water, mostly near Clear Water River. At the rapid "Qui ne parle pas," the river is about 400 feet wide, in other places from 500 to 1,000 feet. Three streams would require bridges from 400 to 500 feet each.

### ROCKY MOUNTAIN PORTAGE AND CANYONS.

To carry the line down through the canyons of Peace River would be a very difficult and costly undertaking. The distance is about 20 miles, and the banks are very steep, leading up to hills 500 to 1000 feet high with deep valleys intervening, in many places the rocks are perpendicular standing from 40 to 250 feet above the river involving tunnels, and heavy rock-work. The width of the river in parts of the canyons is about 200 feet, with deep rapid water.

Across the portage to Hudson's Hope, about 11½ miles, the ground is rough and hilly for four miles, rising in terraces and full of hollows, to a height of about 700 feet. It then falls evenly 230 feet to the high bench above Peace River, and then in two steps or benches 700 feet more to the water of the river. There is no lower ground between Portage Mountain and Bull Head Mountain. Rock appears in the bank of the river and in the upper terrace. The width of Peace River at Hudson's Hope is 708 feet.

Between Hudson's Hope and Dunvegan, 132 miles, the valley of Peace River is not very suitable for railway construction, from the roughness and height of the banks and the deep lateral valleys. Though there are numerous flats and benches on either side of the river, there are also a great many places where land and mud-slides exist, particularly in the lower part towards Dunvegan where the banks are more contracted. The general width of the river is from 700 to 1,000 feet, occasionally widening in shallow places to one mile, and from top to top of plateau from one mile to three; the current from three to seven miles per hour.

Several large streams in deep valleys flow into the Peace River from each side; on the south, Moberly River about 100 feet wide, Pine River 500 feet, Mud River 400 feet, D'Echafaud River 300 feet, and Muskrat River 100 feet, also three streams from 20 to 50 feet wide. On the north side, Middle River 200 feet, Pine River North 300 feet, and several smaller streams from 20 to 50 feet wide.

There is not much land on the Parsnip suitable for agriculture, though some of it may be used for pasture.

Between Clear Water River and the Portage there are some flats which may be cultivated, though the soil is light and gravelly; a large area of the side hills and flats is suitable for pasturage.

Across the Portage the soil is sandy and gravelly.

Between Hudson's Hope and St. John the soil improves and is everywhere fit for pasturage, and in many places rich and suitable for agriculture.

From St. John to Dunvegan the soil is rich and suitable for agriculture for a considerable distance on each side of Peace River. Seed time commences about the end of May. The service-berry is very abundant in the neighbourhood of Dunvegan and St. John, and large game, moose and bear are numerous. A few buffalo are reported to have been seen in the Spring near Mud River.

The timber on the flats and side hills of Pack River, the Parsnip and Peace River is spruce, cotton wood, poplar, black pine and birch; large and of fine quality towards MacLeod's Lake, and decreasing in size towards Dunvegan, where the wood is principally second growth poplar, cottonwood and spruce.

### PINE RIVER TOWARDS SLAVE LAKE.

On the 5th of August, in company with Mr. Cambie, I left Dunvegan, crossing over by land to a point on Smoky River, near the projected line from Pine River to Slave Lake.

Having selected a crossing at Smoky River, Mr. Cambie continued the exploration to Slave Lake, and I proceeded to Pine River, making a circuit to the south through a part of the "Grande Prairie," turning north about the longitude of Dunvegan, and then westerly in the direction of the projected line above mentioned to Pine River.

I met Dr. Dawson, who had come over the Pine Pass with the pack trains, on the 15th August, at a point west of Muskrat River.

Commencing near the lower forks of Pine River, it will be necessary to deflect the line about 9 miles to the north to avoid high ground lying to the east.

There is a good crossing of the river about half-a-mile below the Forks, with a bank about 60 feet high leading to it on the west side, extending up to near the canyon above the Forks.

The bank on the east side is about 60 feet high, in front of high ground, from 500 to 600 feet above the river.

The bridge should have 500 feet of waterway and be about 70 feet above the river, the bottom of which is rock.

For 8 miles along the east bank the work will be heavy with a grade of 1 per 100. The slopes of the bank are not difficult except in a few places. Sandstone rock crops out at a height of from 100 to 500 feet, and the slope above is grassy or wooded. There are no large streams or deep coole's in this distance.

The line will then enter the valley of Favel's Creek and continue in it to its source, a distance of about 7 miles; here there is a stream flowing north-easterly to Peace River. This summit is about 700 feet above the crossing of Pine River. The valley of Favel's Creek is about a mile wide, getting narrower towards Pine River. The bottom is wide and flat, but narrow with high banks as it nears the river. The ground to south and north is much higher, extending for a considerable distance in each direction.

Between this summit and Mud River, about 19 miles, the line is carried still further northward, passing round the foot of a range of hills. The country is nearly level to within 5 miles of Mud River, and the work will be light. The approach to Mud River on the west is easy. The crossing of Buffalo Creek will require a bridge about 50 feet. With the exception of a stream 20 feet wide, the rest are small.

The crossing of Mud River will require a bridge of 400 feet, 60 feet above the river.

To overcome the summit east of Mud River, which is about 340 feet above the crossing, keeping the grade down to 1 per 100, it is necessary to lengthen the line to 5 miles, by placing the crossing some distance up Mud River; this part of the work will be heavy in places.

From this summit the line follows down the valley of Dawson's River to the D'Echafaud, and down that river to the crossing, a distance of about 16 miles, descending about 700 feet. The valley of Dawson's River is wide, with even slopes and hills on each side. The work will be light. D'Echafand River has banks 250 feet high, very steep in places, and work will be heavy in approaching the crossing, probably for 3 miles. It will require a bridge 300 feet long, and about 60 feet above the river.

From the crossing the line will keep on the east side of the river for a distance of 3 miles to a lateral stream, which it will follow to the next summit, 22 miles. The ascent in this distance is about 600 feet.

The lower part of the valley of this lateral stream has high banks, sliding in places, with some deep coole's entering from the south. The work in the D'Echafaud valley, and for some miles up the stream, will be heavy. The ground is even for the remaining distance.

The country lying to the east of this watershed is even and undulating, the only difficulty being the crossing of streams, some of them with deep valleys.

About 6 miles from the summit there is a stream, with a valley 60 feet deep and narrow, requiring an opening of 80 feet. The line is placed to the south of a branch of the same stream, from the west, running parallel to it. The descent to this point is about 260 feet.

A branch of Muskrat River is crossed in about 6 miles in a small valley with a bridge of 80 feet. The line will then keep to the south of this branch to secure a favourable crossing of Muskrat River, distant about 5 miles. Where the trail crosses this river, below the Forks, the valley is 240 feet deep and one-third of a mile wide at top. The line crossing will probably be narrow, and about 100 feet deep, with a bridge of 80 feet opening. The descent in the last 11 miles is about 260 feet.

Between Muskrat River and Ghost River, about 7 miles, the ground is nearly level, the line passes round to the north of some high ground rising to the south, and then follows a more southerly course to Smoky River.

The valley of Ghost River is small; it will require a bridge of 50 feet, about 30 feet high.

Between Ghost River and Brulé River, about six miles, the surface rises 90 feet in one and one-third miles, then keeps about the same level to the banks of the river. The country is gently undulating.

The valley of Brulé River is about one-third of a mile from bank to bank, and 30 feet deep. A bridge of 50 feet opening and 70 feet high will be required. The approach on the west will be heavy for about a mile.

On leaving Brulé River, the line will pass over a water-shed between Peace River and Smoky River, the ground rising 130 feet in about four miles. It then descends into the valley of Katoot Creek and Wicked River, which flows into Smoky River, near the proposed crossing, in all about 26 miles,

Work will be heavy for a mile east of Brulé River, then light over the water-shed and down the valley of Katoot Creek for a considerable distance. This valley is wide and even until it approaches Wicked River, when it becomes deep and narrow with bold lands and occasional land slides. The valley of Wicked River is also of the same difficult character to its junction with Smoky River.

The descent from the water-shed above mentioned to the level of Smoky River is about 700 feet in 22 miles.

In the vicinity of the mouth of Wicked River, the valley of Smoky River is from 400 to 500 feet deep, about a mile wide from top to top, with an interval or flat from one-fourth to one-half a mile wide on either side of the river. The slopes of the banks are generally good and stable, with ledges of sand-tone appearing occasionally.

Where there are sharp bends, and the current approaches the banks, there are sometimes land slides from 50 to 100 feet high.

The bridge is proposed to be 100 feet high with a water-way of 750 feet.

On crossing the river the line will follow the right bank, keeping in the valley through a long reach to the eastward, or until the level of the plateau is gained. The grades west and east of the river will exceed 1 per 100, and the works will be very heavy for at least three miles on each side of the bridge.

The remainder of the route to Slave Lake, was examined by Mr. Cambie, who then returned to British Columbia *viâ* the Pine Pass. *En route* he examined the country lying to the north of the Peace River to Hudson's Hope, thence across by Moberly's Lake to Pine River.

As the season was now well advanced (5th September), and the prospect of meeting Mr. Tupper to the west of the Athabasca was very uncertain, he being still at Edmonton on the 2nd of August. We decided that the remainder of the exploration eastward should be divided between Dr. Dawson and myself. Dr. Dawson undertook the examination *viâ* Slave Lake to Lac La Biche, and I continued south-easterly from the upper crossing of Smoky River, the position of which we had previously decided, towards Dirt Lake.

Dr. Dawson accompanied me to the Athabasca, thence he travelled by canoe to Slave Lake, having sent his assistant by the H. B. route to examine the country north of Slave Lake. We met at Edmonton on the 20th of October.

## PINE RIVER TOWARDS DIRT LAKE.

From the crossing of Pine River near the Lower Forks for a distance of about 50 miles, this line will be common to the one leading to Slave Lake, except that it will keep the south side of Dawson's River.

It will then follow up the south bank of the east or main branch of D'Echafaud River to the watershed between it and Smoky River, about 28 miles.

The ground is about 400 feet lower at 50 miles than the summit west of the D'Echafaud, and the line will preserve nearly the same level for two miles to the crossing of a considerable stream coming in from the south. An opening of 50 feet will be required here, and the approaches on each side will be very heavy.

The line will then ascend the east branch, rising about 200 feet in 12 miles. A few miles at the lower end will be difficult of construction, as the banks are high, rough and broken, with rock exposures in places. The country to the north and south is high and broken, rising from 600 to 800 feet above the valleys.

For the rest of the distance to the watershed the valley is more even, and the work will generally be light. The remainder of the assents is about 470 feet.

On passing the summit the line will follow the valley of Beaver Lodge River for 14 miles, then passing over a low divide to Bear River and crossing it the line will follow its north bank to its junction with Elk River, which stream it will follow to Smoky River, in all about 57 miles.

The valleys of these streams are wide with even slopes, except the lower part of Elk River, where the banks are steep and bold. The work will be light, except for about two miles as above.

The ground falls about 100 feet in two and a half miles to the crossing of Beaver Lodge River. This stream will require an opening of about 50 feet.

The descent to the divide between this and Bear River is about 270 feet, and the remainder of the descent to Smoky River, about 850 feet.

Bear River will require an opening of 80 feet, and another stream flowing into Bear Lake 30 feet.

The best crossing of Smoky River is at the mouth of Elk River, where the bridge will be 500 feet, about 30 feet above the river, The banks here are from 300 to 400 feet high, and about three-quarters of a mile from top to top. In many places where the stream touches the base of the slopes, the land slides from 60 to 200 feet high. There are generally flats on either side of the river.

The line will follow the east bank for two miles to the mouth of Simonette River; about a quarter of a mile of this will be heavy on account of land slides.

From Smoky River to Little Smoky River the greater part of the work will be easy, as the country is even and undulating. The line will cross Simonette River, and having ascended to the plateau level, will follow the river's course for a considerable distance, then the valley of a tributary stream to its source, within eight miles of Little Smoky River. There are a few large coole's cutting through the north bank of Simonette River, and it will be necessary to keep the line near the bottom of the valley till they are crossed. The banks of Simonette River are 400 feet high, 2,000 feet apart, and the work will be heavy in places till the upper level is reached. The bridge will be 500 feet water-way and 30 feet high. The distance from Smoky River to the watershed of Little Smoky River is about 68 miles, and the ascent in distance about 1,100 feet.

The line will then descend to the crossing of Little Smoky River, failing about 130 feet in 12 miles. This valley is about 100 feet deep, and from a quarter to a half mile wide. The banks are generally even, with occasional land-slides and some rock exposures. The stream will require a bridge 300 feet opening and 30 feet high.

Between Little Smoky River and the Athabasca, there is a high ridge of hills, extending in a north-easterly direction, and parallel to the Athabasca. The most favorable pass in the neighborhood of our trail is by the valley of Marsh Head River. There are, however, two other valleys more to the north, or lower down Little that of Smoky River, the stream flowing through the Eoswagun Lake, and also of Goose River, where favorable lines may be found to the Athabasca.

These hills rise to a height of about 700 feet above Little Smoky River, and 600 feet above the Athabasca.

To reach the valley of March Head River, it will be necessary to deflect the line to the south for 10 miles, where the dividing ridge is about 500 feet above Little Smoky River. It will then descend the valley of Marsh Head River to its junction with the Athabasca, falling about 400 feet in 20 miles. The valley of Marsh Head River is broad, and the slopes good, the bottom flat and marshy. The work on this portion will be moderately heavy, there being some deep cross valleys.

The Athabasca is a large rapid river in a deep valley, from three to four miles wide at top, and about half a mile in the bottom. There are numerous islands, flats, and benches standing from 30 to 100 feet above the river. The crossing will be near the mouth of Marsh Head River, and will require a bridge of 600 feet opening, 30 feet high.

Between the Athabasca and McLeod Rivers, the country is very hilly and broken. Immediately to the east of the Athabasca the hills are 900 feet above the river, increasing in height to the south, and also towards the McLeod. One of the ridges passed over on the trail is 1400 feet above the Athabasca. The intervening valleys are from 300 to 600 feet deep. Towards the north the hills gradually decrease in height, and terminate near the Athabasca.

To overcome these difficulties it will be necessary to follow a circuitous course, northward, passing round the shoulders of the hills, and up the valleys. The undulations will be about 300 feet and the grades nearly 1 per 100 throughout the greater part of the distance, 58 miles. The work will generally be heavy, particularly at the crossing of a large rapid stream, flowing into the McLeod, which will require a bridge 100 feet long and 100 feet high. Three other streams will require bridges from 30 to 100 feet each.

A practicable line may also be found by following down the Valley of the Athabaska, to near the confluence of the McLeod, then up the latter river to the crossing. This course will suit the lines viâ Goose River, or Eoswagun Lake above mentioned.

Where the line crosses the McLeod, the ground is about 200 feet higher than at the Athabasca crossing. A bridge 300 feet long and 40 feet high will be required. The valley is wide and even, and the banks of the river 100 feet high, with occasional low flats. Sandstone rock appears in many places.

Five miles west of the McLeod we reached Mr. Tupper's trail, and ascertained that he had returned to Edmonton, in consequence of the difficulty of cutting through the windfalls, and being short of provisions.

The trail was made for some miles further west, and some of the party had gone on foot to the Athabasca, and had left a memorandum at the river, which Dr. Dawson found, on his journey down.

The line, on leaving the McLeod, will ascend to the watershed of the Lobstick, 7 miles with a rise of 300 feet, following the valley of a small stream. On about a mile of this, near the McLeod, the work will be heavy and the rest light.

It will then descend by the north-west branch of the Lobstick to Dirt Lake reaching it in 15 miles, and falling about 300 feet. The valley of this stream is broad and swampy, extending a considerable distance to the south. To the north the country is high and hilly, apparently for a long distance. Work will generally be light to Dirt Lake, except the crossing of three streams requiring bridges of 30 feet.

From the head of Dirt Lake to the located line, the railway will follow the north shore, and cross the Lobstick near the lower end of the lake, thence along the south side of the Lobstick; in all about 20 miles. The fall in this distance will not exceed 50 feet.

The north-western shore of Dirt Lake is bold and broken, rising to high hills for two-thirds of the length of the lake, causing heavy work. For the remaining distance, the ground is even, but marshy, and the work will be light.

The Lobstick will require a bridge 100 water-way and 30 feet high.

The total distance from Pine River to the located line, as above, is 347 miles, joining the located line near the 1,272nd mile, or station 268 of Lucas' Survey.

All distances given in this report are estimated, in most cases by the various rates of travel, checked occasionally by observations for latitude; but as the country traversed is very rough, and filled with windfalls and brulés, particularly from Pine River to the Lobstick, they should be considered as only approximately correct.

The rise and fall are taken from constant readings of a small aneroid, which method can only be relied on for comparative heights, taken at short intervals of time.

### SOIL, TIMBER, &C.

The land most suitable for agriculture is found in the plateaux of the valley of Peace River and its tributaries. These plateaux extend from 4 to 20 miles on each side of the banks of the rivers, decreasing in width towards the sources, and are separated from each other by ranges of hilly broken country forming the watersheds between the tributaries.

The best part of the country may be comprised in the space between latitude 54° 30′ and 56° 30′, and between longitude 117° and 121°, in the shape of an A, with its apex near Hudson's Hope. A very considerable portion of this area is taken up with the ranges of hills above spoken of.

The plateaux stands from 800 to 1,000 feet above Peace River, and at lesser heights above the tributary streams, according to their distance from the main river. The soil is very rich, resting on a sub soil of silt, but the surface appeared wet and cold, caused probably by recent heavy rains.

On the ridges the soil is generally light, and in some parts sandy.

The surface of the plateaux is undulating and occasionally hilly, with openings or prairies varying from a mile to 5 miles in width covered with grass pea vine, &c.

The rest of the country is covered with woods, generally second growth, of poplar, cottonwood, spruce, pitch pine, birch and tamarac. There are large areas of brulés, and windfalls, making it a very difficult country to explore.

The spruce and cottonwood in the river bottoms, and occasionally on the high lands is large, and of good quality.

From Little Smoky River to the located line at the Lobstick, the soil in the valleys and side hills is generally good, though frequently wet and marshy. On the high ground light, sometimes sandy, and barren, with moss and muskegs.

There are a few small prairies in the Lobstick Valley, the rest of the country is covered with poplar, cottonwood, spruce, pitch pine, birch and tamarac, mostly of the original growth, a large proportion being of good size and fine quality. Brulés and windfalls are numerous, and very extensive in this section of the country.

A seam of coal 8 inches thick was found near the water level of Pine River. Small blocks were found in the gravel of other streams, widly separated from each other.

## CLIMATE.

So little has been done in the Peace River country in the way of grain raising, it is not easy to form a correct opinion, as to its capabilities in that respect.

Wheat has been grown successfully at Hudson's Hope, Dunvegan, and Slave Lake. Barley, oats, and roots may be considered a sure crop, and the ordinary garden vegetables thrive well.

During our stay in the country (August) we experienced frost occasionally. On the 6th, ice formed in the water bucket at night, and on the 21st there were 14° of frost four miles west of Mud River, and about twenty miles south of Peace River. During the day, the sun was hot and powerful. We were informed that frosts occur occasionally in June, but very seldom. In July in the "Grand Prairie," lying south of high ground and to the south of Peace River, summer frosts are said to be less frequent. A comparison of the foliage, in the early part of September, appeared to confirm this.

The snow-fall is said to be from 18 to 30 inches, it has very rarely been known to be much deeper. Horses winter out well on the side hills, where shelter is near at hand.

## PEMBINA RIVER TO THE WILLOW HILLS, WEST OF BATTLEFORD VIA SASKATCHEWAN.

Continuing my journey to Edmonton and Battleford, I made an examination for an alternative line between the Pembina River and the Willow Hills, with the object of avoiding heavy work on the line surveyed in 1875, at various points, viz:

The difficult country between White Lake and the North Saskatchewan; the crossing of this river; also the crossings and approaches to White Mud, Buffalo and Grizzly Bear Coole's.

The proposed line will leave the present location near the 1,265th mile, at the water-shed between the Pembina and Sturgeon River. It will then descend the valley of the latter river, keeping along the north shores of Round Lake, Lac des Isles and Lac Ste. Ann. The line will probably cross the Sturgeon three times to avoid long bends in the river to the north and south, the east crossing being bolew Big Lake, near St Alberts.

From this place it will pass over a low divide to the Saskatchewan, crossing the river, Fort Saskatchewan, about 20 miles below Fort Edmonton. Thence round the north shoulder of the Beaver Hills to the chain of lakes and Vermilion River, the valley of which it will follow till the stream takes a northerly direction. The line will then leave this valley, and passing round the north side of the Four Blackfoot Hills, it will again join the surveyed line near the 1,030th mile in the Willow Hills.

The length of this deviation will be about 230 miles, and will probably be a few miles shorter than the line of 1875.

The upper part of Sturgeon River Valley is wide and even to the outlet of Lac Ste. Ann. The bottom is marshy and the hills rise with even slopes on each side.

At a few bold points on the north shore of Lac des Isles, and on the stream between this lake and Lac Ste. Ann, the work will be moderately heavy and the remainder light. The descent in this distance is small.

From Lac Ste. Ann to the first crossing of the Sturgeon, the valley is narrow, with high ground to the north. The descent here is more rapid and the work will be moderately heavy. The banks at the crossing are about 30 feet high.

Between the first and third crossings, the valley is wider and even, and the work will be light, passing over undulating plains rising to the south up to the second crossing, and to the north between the second and third. The descent in the river in this distance is small. The banks at the lower crossing are about 70 feet high and a quarter of a mile apart. Bridges 100 feet each will be required at the crossings.

From St. Albert to the Saskatchewan the ground is even and undulating, and the work will be light.

The proposed crossing is to an island formed by a slough about 100 feet wide. The banks stand from 20 to 30 feet above the water on each side and are firm and permanent. On the west side there is a flat about two miles long and half a mile wide, rising by an even slope to the plateau level, about 150 feet above the river. On the east side, on leaving the island the flat is narrow, and the ground rises to 70 feet above the river, and continues to ascend slowly to the Beaver Hills, which are here about five miles distant. A bridge with a water-way of 800 feet, will be required across the main channel, and another of 100 feet across the slough. The approaches on each side will be moderately heavy for about a mile.

On leaving the Saskatchewan the line will follow a north-easterly course for about 20 miles to the north end of the Beaver Hills. The ascent in the first 10 miles is about 250 feet, then nearly level. The ground is even and undulating, and the work will be light.

From the end of the Beaver Hills the direction is more easterly to the valley of Vermilion River, about 30 miles.

A stream 30 feet wide is crossed in about 10 miles, running north to the Saskatchewan. The valley is a quarter of a mile wide, and 60feet deep. The water-shed to Vermilion River is two miles east of this stream.

The descent of the Vermilion River is small, and the intervening country is undulating, with occasional hills to north and south. The work will be light.

The line will follow the valley of Vermilion River southerly for about 40 miles, keeping on the north side, along the shores of the chain of lakes. The valley is about one mile wide at bottom, two at top, and from 100 to 150 feet deep; the slopes are even, and there are few places where heavy work will be required. The fall of the stream is small throughout this distance.

To the south the country rises in small hills and ridges to a height of 300 to 400 feet above the river. The Vermilion will require a bridge with an opening of 100 feet. There are no large streams flowing in from the north.

On crossing the river the line will follow a very direct easterly course to the surveyed line of 1875. The work, in ascending to the plateau level, will be moderately heavy for about two miles. In about 30 miles the line will pass over the water-shed to Battle River, rising about 350 feet in that distance.

In this part of the country, the ground rises to the south towards the Four Blackfoot Hills, and is hilly and rolling, with undulations from 40 to 150 feet. The hills are detached, and there will probably be no difficulty in finding a satisfactory line, by keeping to the north of the trail, where there seems to be a valley running in the direction of the proposed line. This course will also be the most direct, while even in the neighborhood of the trail a practicable line can be found. The work will generally be light, and occasionally, moderately heavy.

From the Battle River water-shed to the located line, the country is even and undulating, and the work will be light.

The line above described, between the Saskatchewan River and the surveyed line at Willow Hills is circuitous, and it is probable that, on further examination, a shorter line can be found by crossing the Beaver Hills more directly and following a course leading to the south bend of the Vermilion River, thence to the same point or junction with the line of 1875 in the Willow Hills. This line would cross the Vetf milion near its source, where the valley is probably small, with a bridge of 60 feet opening, and would be considerably shorter than the surveyed line. The grades would not be excessive, but the work would occasionally be heavier.

### SOIL, TIMBER, ETC.

Between the Pembina and Willow Hills, on this route, the soil, with very little exception, may be described as excellent farming land, particularly in the neighborhood of Edmonton and the Beaver Hills.

To the east of Egg Lake the soil is lighter, but still good. Towards the Willow Hills it improves, and is very good. On the slopes and tops of hills it is light and clayey, with boulders occasionally.

The appearance of the country has improved very much in the last three years in the vicinity of Edmonton. There are now extensive farms between Lac Ste. Ann and the Beaver Hills, growing wheat and other grain in large quantities. Several specimens of grain and straw were obtained from the settlers, who seemed to be well pleased with their prospects. Potatoes and root crops are very successfully cultivated.

The country is wooded to a point a few miles east of Lac Ste. Ann; then open prairies, alternating with copses of woods to near Egg Lake, and thence to the Willow Hills, prairie land predominates and wood is generally scarce.

Second growth poplar, cottonwood, spruce and birch are the prevailing woods, but round the shores of Lac Ste. Ann, there is some fine large spruce and cottonwood of good quality.

We arrived at Winnipeg on the 2nd December, having experienced very cold weather between Edmonton and Winnipeg.

I have the honor to be, Sir,

Your obedient servant,

HENRY A. F. MACLEOD,

*M. Inst. C. E.*

**SANDFORD FLEMING**, Esq., C.M.G.,

Engineer-in-Chief.

# APPENDIX No. 4.

## REPORT ON THE TRIAL LOCATION SURVEY, FROM HEAD OF WORK INLET UP THE SKEENA RIVER, BY MR. GEORGE A. KEEFER.

New Westminster, B. C.,
January 23rd, 1880.

Sandford Fleming, Esq., C.M.G.
Engineer-in-Chief.

Dear Sir,—In accordance with the substance of your instructions, my work for the past season has been confined to a trial location from the head of the Wark Inlet through the "divide" to the Skeena River, and thence as far eastward, following the north or right bank of the river, as the season would admit; also embracing an examination of the shores of Wark Inlet with a view to the ultimate extension of the line to Port Simpson, and a general opinion as to the adaptability of that point as a terminal harbor for the Canadian Pacific Railway.

On the 3rd of June last, in company with Messrs. Cambie and McLeod, I left for Victoria on the Hudson Bay Co's. steamer "Princess Louise," landing my party and supplies at Port Essington on the 5th.

Port Essington or Spucksute is a small Indian village or trading post at the mouth of the Skeena, and about nine miles below the southern or Skeena entrance to the divide, leading to Wark Inlet.

On the following day,—Mr. Cambie having secured the steamer for that purpose—an examination of Port Simpson and Wark Inlet was made, and returning to Port Essington, I joined my party the same evening.

As Mr. Cambie has in his report given a full and exhaustive description of the points embraced in that part of your instructions relating to Port Simpson and Wark Inlet, it will be unnecessary for me to give it more than a brief notice, confining myself more particularly to the portion covered by my trial location.

As all nautical authorities have agreed upon the advantages of Port Simpson over any existing harbors on the northern coast, there only remains the question of its capacity and the facilities of its land approaches, to determine whether it may be considered as a fit terminal point for an important railway, and if filling the requirements consequent upon such an important selection.

The area of the harbor is sufficient for the purpose, possessing an anchorage of over four square miles. It is sheltered to the north and west by the shores and outlying islands, but is exposed in part to the S.W. wind; the sea, however, is broken by a reef or kelp bed forming a natural breakwater, but which does not prevent the full force of the wind being felt from that direction, and would possibly prove awkward for vessels exposed to its full force, but there is still a comparatively large area of sheltered anchorage left.

The shores are low, sloping back gradually, easy of approach and suitable for extensive wharfage, and possessing a building area of sufficient extent to meet any requirements of the future.

The entrance to Wark Inlet from the Portland Channel, some eight miles wide at this point, is easy of approach, but not exceeding 2,000 feet in width, with deep water to the base of the bluffs forming the shores on either side.

In the extension of the line from my initial point at the head of Wark Inlet northward to Port Simpson, some 32 miles, the work may be classed as very heavy, and some six miles excessively so. The outline of the shore, although generally direct, is very irregular, sharp indentations are frequent, varied by projecting points of either rock or broken rocky side hill, in profile varying from slopes one, one and a half and two to one. Although the tide rises and falls some 18 feet, there is no margin or beach available for the embankment, and the line must therefore be almost entirely in cutting, which will be heavy and through very expensive material, as I fancy little but solid rock would be encountered in its construction. A depression through which the line can be carried without difficulty, runs from the harbour of Port Simpson through to Wark Inlet.

The head of the inlet cannot be considered as in any way suitable as a terminus; even as a temporary one it has many disadvantages. The area of anchorage assumed at 30 fathoms, exists only at the extreme end, and is of very limited extent, having only a frontage of about a mile in length and a width not exceeding 500 feet from the shore. The bottom is of rock and bad holding ground, and consequently artificial means in the shape of anchoring buoys would have to be provided, and no vesselcould approach her anchorage under sail with safety.

From the same cause, the wharfing would have to be of cribbing, as I have no idea that piles of any description could be used successfully. The shores are so precipitous that but little room can be found for building purposes. In the valley of the two streams emptying into the inlet at this point, there is a small area, but the greater portion of this space would be required for the railway.

We are unfortunately obliged to leave tide-water with a heavy grade and sharp curvature to reach the summit of the "divide." This divide consists of a gap in the mountains forming the north shore of the Skeena, giving access to the head of the inlet. There is a summit of some 260 feet between the waters of the Skeena River and those of Wark Inlet, lying about equidistant from both waters. A large and rapid stream, the "Kla-ah-mah," heading in the small lakes and swamps of the "summit," discharges into Wark Inlet, and a similar one, but smaller, the Kla-ah-dah, into the Skeena River. The distance, taken in a direct line from the inlet to the Skeena, is about 8 miles. Unfortunately for our purpose, the summit consists of a swampy flat nearly three miles across, thus reducing the distance to overcome the ascent from the inlet to four and a half miles. The fall of the creek is too rapid to admit ot following it with the line, consequently we are thrown on the side hill for grade, which is steep, broken and rocky; and our connection with the waters of the inlet is a mile north of its actual head or the mouth of the Kla-ah-mah, and on the western side. A line back from this point, and sweeping round the head of the inlet, would be the most advantageous for a line of wharfing for a temporary terminus, as also necessary to connect with the ground upon which buildings and shops could be erected. In the descent towards the Skeena, a maximum grade of 1 per 100 obliges us to adhere to the side hill, which is even more broken than that ascended from the inlet, and also necessitates swinging up the valley of the Skeeux,—a large tributary of the Skeena,—to attain a proper elevation for crossing that river, after which we emerge on the valley of the Skeena proper, a distance of some 13½ miles from my initial point. Were a steeper grade admissable, say 1.40 per 100, it would enable us to cross the Skeeux at its mouth, and joining the former line at 13½ miles, effect a saving in distance of over 2½ miles besides giving better alignment and lighter work.

The Skeena River is, at this point, about 1½ miles in width, with the same variation of tide as at the head of Wark Inlet, viz., 18 feet, and although the shores are abrupt and rocky, there is a margin of from 200 to 300 feet at low tide.

The line follows the shore as closely as practicable, with a grade averaging 10 feet above extreme flood. I have endeavored so to place it as to economise material as much as possible, and to make the cuttings furnish material sufficient for the banks, a great portion of which will be reached by high tide. As the material is rock, there will be no protection needed. There was no appearance of any abrasion on either trees or bank by the action of ice, and am satified that the embankments will need no further protection than that afforded by the material composing them. Bluffs occur at frequent intervals, in many cases with a depth of water at their base that renders it necessary to keep the line in cutting.

Glacial streams, subject to snow-slides, which would effect the line, have been crossed at an elevation admitting of tunnelling. The bluffs, as a general thing, are of bare, smooth rock, offering no chance for an accumulation of snow sufficient to endanger the work, and which would slide before acquiring any depth or weight; still a covering of some kind would have to be provided to prevent the track filling during a succession of heavy falls.

The shores are, in all cases, steep and heavily timbered, and with very large trees, principally spruce, cedar and hemlock. The ground is covered with a great quantity of fallen timber and dense underbrush, making progress difficult and slow.

These general characteristics exist up to the 34th mile, or the extreme point at which the action of flood tide was perceptible. From this point there is an improvement in the general features of the country, the bluffs become more rare, and large flats of considerable extent more frequent; these flats are, in all cases, heavily timbered, but, with few exceptions, are slightly overflowed at extreme high water.

The width of the river bed continues about the same, averaging from 1½ to 2 miles in width, the main channel alternating from side to side; a great portion of the bed of the river being filled with islands covered with popular and spruce and intersected by innumerable high water sloughs in all directions.

There is a gradual but marked diminution in the quantities and consequent cost in each section of 10 miles up to the 50th mile; the last section located from the 50th to the 60th mile may safely be taken as a fair average, possibly a little in excess of the quantities for a corresponding distance as far as my examination extended, or to the 80th mile.

Upon the receipt of your supplementary instructions under date of September 20th, and received on the 25th October, I made immediate preparations for an examination of the river to the point required, some ten miles above the point reached by the steamer Mumford in 1866. The lateness of the season and a letter from Captain Lewis of the steamer "Princess Louise," stating that he would be at Port Essington on his last down trip of the season on the 8th November, gave me but little time to devote to this portion of the work.

As it was impossible to reach this point with the line, I left the main party in charge of Mr. J. H. Gray to continue location, and with a small force began a micrometer traverse of the river, which would enable me to form an general idea of the comparative quantities of the work. As I have before stated, the general features of the river remain the same, but with a larger proportion of flats, which would effect a saving in quantities. Therefore the last ten miles, as located, may safely be taken as an estimate for the succeeding sections.

As far as the navigation of the river is concerned I do not know that it can be extended above the point indicated at the 73rd mile, as reached in 1866. The current at this point, and in the bend immediately above, is rapid and the water deep, and at the 76th mile a contraction in the river, called the Ksip-kee-agh Falls would arrest further progress during the stage of water most desirable for navigation. In low water the falls disappear, and a swift current, with rocks showing in the channel, would prove an equal barrier to large boats As my examination only extended some four miles above this point, I am unable to speak of what the river is like higher up. The Kitsalas Canyon would, I understand, be another objectionable point. I think, therefore, that for all practical purposes Kitsumgallum, at the 72nd mile, may be assumed as the head of steamboat navigation on the river Skeena, and for this purpose boats of light draft, with powerful engines would be required. Although the point mentioned was reached by a comparatively poor boat, a great deal of trouble was experienced, and in many cases she had to be warped over the frequent "riffles."

My intention was to continue my examination some miles further east or as far as Kitsalas, but on learning that an ice jam immediately above the mouth of the Zymoets some two miles ahead, was moving, made further delay a risk I did not care to incur, as the jam once below me, and a change in the weather, of which there was every indication, our exit would have been rendered a matter of some difficulty, if not impossible in canoes. This state of affairs entirely prevented the possibility of an examination of the valley of the Lakelse to the head of the Kitimat. But from all the information I could gather from the Indians, and from my own observation, I infer there is no difficulty,—should it ever be desirable,—of carrying a line through this valley to the head of Gardner Inlet. A corresponding valley to the north of the Skeena, or rather a continuation of the same valley Northward, would seem to offer equal facilities for egress to the Naas River, should such a route in the future ever come under consideration.

The climate of this portion of the country during the summer months is not an attractive one, the predominating feature being rain; possibly in keeping with the greater portion of this Province, the season of '79 was exceptionally cold and wet. From the date of my first going into camp on June 6th, to the 15th of July, the rain was continuous and heavy; from that time to the beginning of August, the weather was fine with occasional showers, after which there was no break in the general humidity, until varied by snow on the 13th and 17th of Oct., a heavy fall of some 14 inches occurring on the latter date, which, although followed by heavy rains, never disappeared in the wooded country, and up to the date of our stopping work, on the Nov. 2nd, fully six inches of snow remained. This was at a distance of some fifty miles from the coast. The first frost experienced was on the 11th Oct.; this comparatively late date may be attributed to our low altitude and the influence of the sea. From this time until the 28th of Oct., though excessively cold and wet, but little frost occurred; with the advent of November, however, a change into cold with severe frosts closing up the lesser channels and sloughs, gave unmistakeable indications of the near approach of winter. The snow-fall must be very heavy in this region, and if the testimony of the Indians is reliable, and which the appearance of the small trees and bush seem to confirm, it must lie at a depth from six to eight feet. But few Indians winter on this portion of the river; one family at Kitsumgallum, and another at Kitsalas, left in charge of ranches and for the purpose of trapping during the winter, seem to comprise the entire population for a distance of over one hundred miles.

On my return to the coast on the 2nd and 3rd November, the indications of the recent snow fall remained with us for about 20 miles, or to within 30 miles of Port Essington where it entirely disappeared. From this point we again experienced the almost constant rains of this section of the country. During my stay in Port Essington, the rain was constant, though light, and the weather mild. On the following day, November 4th, I paid off the Indians, and embarking in the "Princess Louise" on the morning of the 9th, reached Victoria after a rough trip on the 12th.

The result of my season's work may be assumed as demonstrating the entire feasibility of this portion of the river Skeena as a practicable route for a railway. The work on the Skeena proper is not excessively heavy, the cost being more owing to the nature of the material than from any great excess of quantities. The tributaries crossed are easily bridged and in all cases have but a slight depth of water.

With the entrance to the " divide " and extension to Port Simpson the work becomes rather fomidable, but with nothing exceptionally difficult in construction.

Should any future necessity occur for reaching Gardner Inlet, as a terminal point, the valley of the Lakelse offers easy access to that point from the valley of the Skeena, and similarly, the Naas can be reached through the valley of Kitsumgallum River, to the north, and through which there is a trail to that point in present use.

The extent of my work was not as great as I should have liked, but the detention in the divide, in which trails had to be cut and supplies packed, the difficult side hill, and heavy timber, all proved obstacles to rapid progress; but I trust enough has been done to demonstrate satisfactorily the comparative cost and quantities embraced in a distance of some 80 miles eastward from my initial point or the temporary terminus at the head of Wark Inlet.

I have the honor to be, Sir,
Your obedient servant,
GEORGE A. KEEFER.

# APPENDIX No. 5.

## REPORT OF CHARLES HORETZKY UPON AN EXPLORATION THROUGH THE NORTHERN PORTION OF BRITISH COLUMBIA IN THE SEASON OF 1879.

OTTAWA, 25th February, 1880.

SIR,—In accordance with instructions received last May, to proceed to British Columbia and make an exploratory survey of the northern portion of that Province, between the rivers Skeena and Ominica, in as direct a line as possible, with the view of ascertaining the practicability of a railway route in connection with a line from Fort Simpson to the Forks of Skeena, between the last-named point and the Peace River Pass of the Rocky Mountains, I proceeded to Victoria and reached Hazelton (the Forks of Skeena) on the 25th of June. Messrs. Cambie, Dawson, McLeod and the Reverend Mr. Gordon had preceded me by a few days, and were then midway between Hazelton and Lake Babine, on the now excellent trail over which I had passed on my journey from the Peace River to the Pacific Coast in December, 1872.

As you are aware, before entering upon this work I had but little belief in the existence of any practicable passage through the central range of mountains lying between Lakes Babine and Tatla, north of the latter, although a hasty examination of the country during the winter of 1872 and 1873 had led me to believe in the possibility of a route from Lake Babine to the south of Lake Tatla, towards the Nation Lake region and south branch of the Peace River. Our existing knowledge of the country assigned to me for examination upon this occasion was, of course, vague and unsatisfactory, and under the circumstances it became absolutely necessary to make a preliminary journey of reconnoissance embracing the unknown region included between the River Skeena, Bear Lake, the valley of the Driftwood River and the Frying Pan Pass, for, within that area, the key to the passage from the Skeena eastward had to be sought.

This preliminary work presented no slight difficulty, it being of primary importance that no time should be lost in what might ultimately prove to be useless examinations, while the knowledge possessed by the Indian tribes of the country was confined to mountain trails utterly unsuited for the object in view. Fortunately, I laid down the course of a journey which enabled me in the space of three weeks to decide upon the general line of route best worthy of examination, and after several days spent in collecting all available information, I decided upon a journey from Hazelton up the Skeena to the Kiskargasse Village, on the lower portion of the River Babine, thence northward *viâ* the Atnah Pass to Bear Lake, south-eastward to Lake Tatla, and thence back to Hazelton. By this procedure I hoped to find out all the available mountain passes.

An important feature in the work about to be undertaken was the determination of a chain of levels across the mountainous country indicated. With this object in view, I provided three mercurial cistern barometers and the other necessary appliances for obtaining a correct series of simultaneous meteorological observations at different stations, whence reliable hypsometrical results could ultimately be deduced. Hourly readings were at once instituted, and kept up by two members of the party until the month of September, by which time data for all the most important levels were secured.

On the first day of July every preparation having been completed, I took my departure from Hazleton *en route* for Kiskargasse, an Indian village on the lower

Babine River. We reached that place on the fourth day, having travelled so far upon a fairly beaten Indian trail which follows the left bank of the River Skeena until opposite the mouth of the Babine River, whence it is carried over level terraces to the upper Kiskargasse Village situated upon the right bank of the Babine River, forty miles distant from Hazleton, and six hundred feet above that datum, to which all the levels are henceforth referred. The topographical features of the valley of the Skeena from Hazelton to the Babine River, a distance of thirty-three miles, require no minute description here, as they will be referred to farther on. The lower portion of the Babine Valley, from the river mouth to the upper village of Kiskargasse, is open; fine, broad and level terraces presenting a park-like and very pleasing aspect, and comparing most favorably with the valley of the Skeena.

The lower village of Kiskargasse is situated upon a terrace 75 feet above the level of the Babine River; the land here is of a semi-prairie character, and from this point there is a magnificent view to the north-eastward of the Atnah mountains, of which the highest peaks, some ten miles distant, rise to elevations of at least 9,000 feet above sea. A couple of miles higher up is situated the upper village, consisting of a dozen large houses, which we reached by means of a very precarious-looking suspension bridge swung over the entire breadth of the Babine, here a seething cataract and mass of foam, which boiled and roared beneath at a great depth between perpendicular walls of slate rock. The village stands at least 100 feet higher than the bridge upon a fine, level terrace, which extends both up and down for a considerable way.

The Indians here are a wild and treacherous set, and appeared to be inclined to throw obstacles in our way. They were especially jealous of my Frazer River Indians (I had brought five men with me from the Frazer River) whom they looked upon as intruders. Delaying as short a time as possible amongst those filthy savages, we proceeded on our way, having first secured the services of a couple of Indians of the place as packers. The trail, if such it may be called, from Kiskargasse to Bear Lake, ascends the slopes of the Atnah Mountains immediately after leaving the village, and we encamped some six miles from the latter, high up on the mountain. On the 8th July, Sunday, we moved higher up and camped again at noon just beyond the limit of the forest, at an elevation of 5,000 feet above the sea, and probably about eight miles from Kiskargasse, which bore S.W. ½ S. mag. Although in the midst of summer, our camp was surrounded by large, and in some places, very deep patches of snow, which, under the influence of the July sun, was rapidly melting away, giving rise to innumerable rivulets of ice-cold water which saturated the ground in every direction and caused walking to be anything but a pleasant pastime. To the northward, the pass of the Atnah, through which our way lay, could be seen still higher than our camp, flanked on each side by high beetling mountains covered with perpetual snow. Looking southwards, and across the valley of the Babine River, a lofty, serrated and snow-clad range of mountains could be traced from the left bank of the Skeena eastward towards Lake Babine completely filling up the immense area between the Babine and Skeena Rivers, while to the west and south-west the same monotonous and dreary wilderness of peaks and utter desolation met the eye. The only striking change in the landscape was to the eastward, where, some fifteen or twenty miles distant, there appeared to be a low depression covered with dense forest, evidently the valley of some large stream.

On the morning of the 7th, we decamped at 5 a.m. and began the ascent of the Pass. Although there was every promise of a very fine day, a dense fog enveloped the mountains and wet us to the skin as we trudged along through water and snow. A little lake lay not far from the summit, but we skirted its ice-bound shores, along which were piled in endless confusion huge blocks of ice and debris from the crags above, while now and then we were startled by the crash of newly disintegrated portions which, sometimes rolled across our path. At 7½ a.m. we crossed the summit [6,000 feet above sea] in the midst of a pelting rain. On the northern slope our way lay along a very extensive and dangerous snowbank which sloped downwards at a steep angle and some five hundred feet below terminated at, and hung over, the edge of a precipice. Fortunately for us the temperature was sufficiently high to soften the snow and enable us to obtain good foothold, and by carefully feeling our way we crossed in safety.

The Indians say, that here, during the winter, storms rage fearfully, and the winds blow with such violence that stones are actually blown about. In confirmation of this statement we saw many loose fragments embedded in the snow, which could not have been placed there by any other agency. At 9 a.m. we had decreased our elevation considerably, and halted for breakfast, which we discussed in a perfect cloud of mosquitos, although still above the snow limit. Twenty-five hundred feet below the summit level we forded a large torrent flowing to the east south-east, and at 2 p.m. were brought to a stand-still by a formidable glacial torrent from the north-west. This we were obliged to bridge, an operation of no slight difficulty, as trees of sufficient length had to be cut and hauled from a long distance. A day was spent over this work and the morning after we effected a crossing. From this bridge, nine and a half hours continuous marching brought us to the summit of a third range, (an inferior summit had been crossed during the interval) even higher than the Atnah Pass, and whence the Bear Lake mountains were visible. This, one of the most trying days of the season, was diversified by changes from swamp and forest to wind swept heights covered with eternal snow, the lower slopes being sodden like a wet sponge, and exuding copious streams of ice cold water, which rendered it utterly impossible for us to keep dry. In fact, I may say, that from Kiskargasse to Bear Lake the only dry places were the snow patches, which we eagerly sought whenever within access.

From the last mentioned summit there opened out a magnificant view of the country to the South. The low-lying and apparently level valley of the Neelkitquah, a northern tributary of the River Babine, rising in about latitude 56°, and entering the latter a few miles below the outlet of Lake Babine, could be traced for many miles of its course.

From this summit numerous glaciers could be seen to the north-west. We camped 1,000 feet lower down, on the driest spot available, just below the timber line and in the shelter of a little grove of stunted pines. Three-quarters of a mile to the westward there glistened a glacier of huge proportions, the source of a rather formidable stream which we forded next morning.

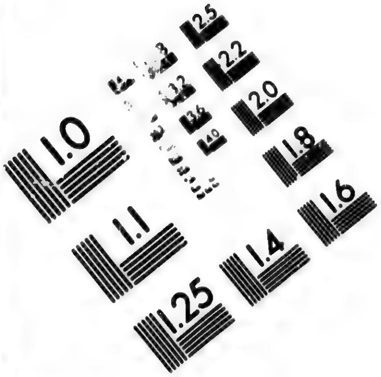
From this camp, the southern end of Bear Lake bore about N. by E. mag., but another high range yet intervened,

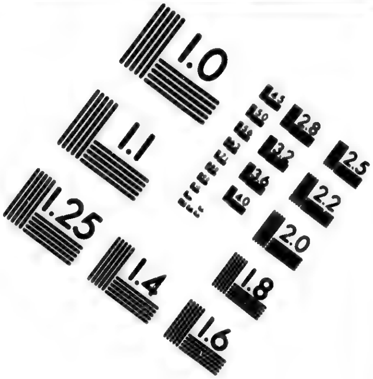
Following up the valley of the Neelkitquah into which drained several large glacial torrents from the N.W., we left that stream and crossed a watershed, descending afterwards into the valley of Driftwood River. Crossing this stream, we ascended the (4th) range bounding Bear Lake on the west, and reached the lake shore in the afternoon of the 12th of July. The formation throughout, from the Babine to Bear Lake, appears to be slate.

Bear Lake lies at an elevation of 1,879 feet above Hazelton, or, approximately 2,604 feet above sea level. It is a narrow sheet of water extending from the parallel of 55° 57′ for about twelve miles, in a N. by W. direction, with a width varying from a quarter, to one mile. It discharges into the Skeena. The Lake lies apparently in an anticlinal fracture, the general strike of the strata, which are exceedingly well marked on the eastern side, being about W.N.W. mag.

The mountains, by which the lake is encompassed are from 3,000 to 4,000 feet high on the western side, rising back to as great an elevation in the opposite direction. To the North, the country appears very rough. Before descending to the lake shore, we took the precaution to make a smoke signal, which fortunately for us attracted immediate attention at Fort Connolly, some ten miles distant, as four hours later a canoe arrived at our camp. It is as well to remark here, that from the heights to the south-east of Bear's Lake we had a capital view of the valley of the Driftwood River; the upper end of Lake Tatla was also visible 30 miles distant.

After paying a visit to the Hudson Bay Company's post at the lower end o BearLake, and making extensive enquiry, I abandoned the idea of any examination





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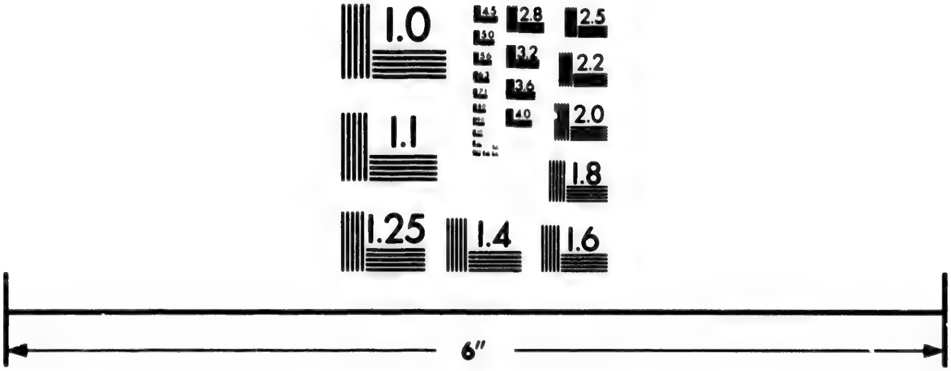

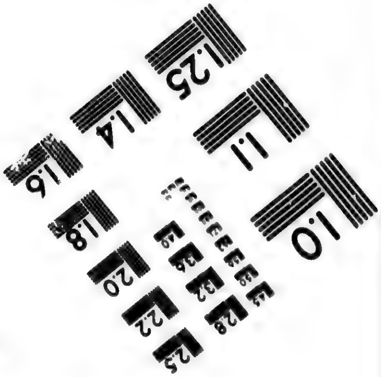

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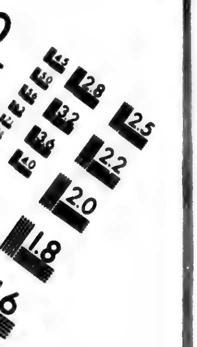
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to the northward, much as I should have wished, but time was wearing on, and here I may take the occasion to say that one of the greatest difficulties attending this season's operations was in deciding where not to go, as every day was precious, and our delays innumerable. I had now seen portions of the Babine and Neelkitquah River valleys, and felt sure that if there existed a fairly practicable pass through the mountains lying between the Neelkitquah and Driftwood Rivers, the problem of finding a passage from the Skeena to Lake Tatla would be satisfactorily solved.

Hiring three small poplar dugouts, we retraced our way to the upper end of Bear Lake, made the portage from the latter into the Driftwood River, and ran down to Lake Tatla at a rate which compensated to some extent for our slow progress between Kiskargasse and Bear Lake.

The "Driftwood," although at a low stage, was yet very swift, the average fall in the upper portion being at least 12 feet per mile. The distance from Bear Lake to Lake Tatla, by following the sinuosities of the stream, is about thirty-five miles, and the difference of level between the lakes is 333 feet. The valley of the Driftwood is low, wide and of a generally easy character. On the western side it is flanked by an elevated range of mountains, extending from Bear Lake to the Kotsine River; while on the east, the ground rises by easy gradations to a lesser elevation, forming, some ten or twelve miles distant, what I have designated as the "Omenica" range, a chain of low mountains or, more appropriately, hills, through which, in several places, there appear to be low passes to the Omenica Valley. Unfortunately, the valley of the Driftwood, having a south-easterly direction athwart the course of the line I was in search of, is, with the exception of its lower portion, unavailable.

Running down to the parallel of 55° 45', I saw a gap in the range to the westward. whence came a tributary of the Driftwood, called the "Kotsine." Westward, from the same summit, another stream flowed into the Neelkitquah. Such was the information gathered from a Bear Lake Indian whom I had with me. This pass, which proved afterwards to be fully fifteen miles distant, I roughly guessed to be about 3,000 feet above sea level, but deferring its examination to a future opportunity, hastened on to Lake Tatla, the while anxiously scanning the range to the eastward for indications of a pass to the Omenica.

Here it may be remarked that the chain of navigable waters extending south-eastward from Fort Connolly, in about latitude 56° 6' north, to the Detroit or narrows of Lake Tatla, in latitude 55° 9' 30", a distance of eighty miles, is flanked on both sides by a nearly continuous range of mountains; that on the western side being the higher and more precipitous, but broken in two places by the Driftwood and Kotsine River valleys, the latter being the key to the route discovered this season. On the eastern side of this great trough (as the depression in which those waters lie may not inaptly be termed), as has been remarked, the mountainous chain is of a much lower altitude, and is pierced at several points by comparatively low passes, of which the lowest are: one behind the site of Buckley House and communicating with the Omenica by the Omenica-Sitleca, the other the pass at present used by miners, which connects Lake Tatla with the Omenica by the valley of the Fall River. The latter I adopted further on in the season as being in all probability, the lowest, most direct, and easiest of access from the low valley of the Driftwood River.

The only known route to the northward of Fort Babine, across the western or central range separating Lake Tatla from Lake Babine, is that of the "Frying Pan Pass", a low depression nearly 5,000 feet above sea, perfectly unsuited for a railway, and at the best, but a wretched pass even for foot passengers. From these facts, it will be seen that, but for the depression of the Kotsine Pass in lat. 55° 45' a direct line from the Skeena to the Peace River would be impossible, and I have no hesitation in saying that the route now laid down *viâ* the Kotsine Pass is the only one at all suitable for a railway north from Middle River, or, the outlet of Lake Tatla.

From Tatla Landing to the village on Babine Lake *viâ* the "Frying Pan Pass," the distance by the trail is perhaps thirty-five miles, but certainly not more than twenty-seven as the crow flies. With the exception of a little good land near the lakes, the country is worthless for agriculture, and very much broken. On each side of the "Frying Pan Pass" the mountains are high, one peak being at least 3,000 feet above the eye, or 8,000 feet above sea, and from the Kotsine Pass to the Detroit, near the lower end of Lake Tatla, the entire distance between the two lakes is occupied, with scarcely a break in its continuity, by an irregularly disposed and lofty mountain chain.

On reaching Lake Babine on the 20th July, I found one of my meteorological observers in camp. He had arrived on the 4th, and since then had kept an hourly register of barometrical and thermometrical fluctuations, while another was similarly engaged at Hazleton.

Leaving the Babine observation camp on the 22nd, I encamped a little to the westward of the Susqua Summit, in order to obtain simultaneous readings for difference of level, being somewhat doubtful of the accuracy of my aneroid readings of December, 1872. The result proved my former estimate to be too high, the true elevation now ascertained being 1,400 feet above the level of Lake Babine. From the summit we reached Hazleton easily in two days, passing on the way four camps of the Peace River party.

Having now acquired a general idea of the topographical features of the region through which a line seemed feasible, I determined to ascend the River Skeena in a canoe for the purpose of making a micrometrical survey as far as the mouth of the Babine River. It was, however, impossible to obtain assistance from the Skeena River Indians, who were afraid to risk the dangerous navigation of the Upper Skeena. Fortunately I was enabled to secure the services and canoe of a Metlahkatlah Indian, who had recently come up from the coast and was willing, for a consideration, to accept all risks. My own men were excellent canoe men, so that I now felt quite independent of the natives. We reached the mouth of the Babine River after seven days arduous and extremely dangerous navigation, the distance made during that time being 38½ miles. I was fortunate in choosing our time, the Skeena being then at a good stage, a week earlier it would have been impossible to ascend it, the river being a continuous chain of bad rapids, and flowing in many places through narrow canons, in several of which we passed hundreds of Indians busily engaged in the salmon fishery. The excitement created amongst them by the passage of our solitary canoe was intense, ours being the first ever to ascend so far in safety. Some of the Kiskargasse Indians even went so far as to encourage us with charcoal drawings on tree stumps, representing our canoe bottom up, with all its occupants swimming for their lives. Indeed, the jealousy manifested by those savages was very great, and at one time promised to lead us into trouble. We got along very well, however, until the Babine River was reached, when a cold-blooded murder was committed by a Kiskargasse Indian, and during the excitement consequent upon this, we were warned not to ascend to the village. I pushed on, nevertheless, but my crew beginning to manifest signs of discontent, and the owner of the canoe flatly refusing to go a step further, he having years ago taken the life of a Kiskargasse, and now fearing retaliation, I finally turned back, my intention having been to continue the survey of the Babine upwards as far as the lake outlet.

Returning to Hazleton, I determined upon a survey of the Babine from the lake outlet downwards. Before doing so, I was, however, induced to attempt a passage from the Skeena to the Babine, by the valley of the Skeguniah, an eastern tributary of the Skeena, entering the latter a little above Kyspyox, and its valley presenting a very favorable appearance from the last named village. The object was to avoid the enormous bend of the River Babine, which, in the event of the Skeguniah proving a failure, presented the only means of access to the eastward. Accordingly, I engaged the services of an Awkilget Indian, and set out again from Hazleton on the 7th August, with the intention of penetrating the maze of mountains as far as the River Babine, on a course parallel to, but north from, the valley of the Susquah.

Ascending the valley of the Skeguniah, I found it to be of so rough a character that we were obliged to abandon the adventure and strike over the mountains for Lake Babine, where we reached the observation camp eight days later, the entire party completely knocked up from fatigue and over exertion, but now possessed of the definite knowledge that the only way from the River Skeena to the eastward is through the Babine Valley.

I began the survey of the Babine River on the 18th August, and after making a micrometrical traverse for 25 miles below the fishery, examined the valley for some distance down, but failed to reach the upper Kiskargasse village. Quite sufficient of the valley was, however, seen to enable me to state that it is quite practicable for a railway, although of a rough character for probably a dozen miles above the upper village of Kisgargasse. From the isolated mountain in latitude 55° 38′ north, and slightly west from the Neelkitquah, I commanded a view of the Hudson Bay House on Lake Babine and of the lower Babine valley, and although the village of Kisgargasse was hidden by a low spur, its position was recognisable. Below the outlet of Lake Babine the river flows between low banks, which gradually increase in height until when, fifteen miles lower down, they rise to elevations of 250 or 300 feet, and increase probably to 500 feet when within half a dozen miles of the upper village of Kisgargasse. Above the terrace upon which the latter is situated, the right bank, covered with dense forest, recedes at a moderate inclination, the mountains proper being far back.

Being satisfied as to the feasibility of the Babine valley, I returned to Lake Babine, and shortly after commenced a micrometrical survey of the River Neelkitquah, up which the projected line had to be taken. This is a very rapid stream, draining a large area, and receiving numerous glacial tributaries, several of which we had crossed on our journey to Bear Lake. At this time its waters were low, and we were enabled to ascend it with two dugouts. Thirty-one miles from its mouth we reached a little stream supposed to come from the Kotsine Pass, and abandoning our canoes, we pushed north-eastward through the dense forest towards the Pass, the summit of which proved to be six miles distant. A small stream flows from the summit westward into the Neelquitquah, but falls into the latter some distance above our canoe camp. This pass, although available for a railway, proved eventually to be several hundred feet higher than I had anticipated. Thence to the Driftwood River we found our way with great difficulty. From Lake Tatla, the country was examined *viâ* the "Hogem" Pass and down the valley of the Fall River to the Omenica, the survey being brought to a close at the mouth of Germansen Creek. An unexamined break of about fifty miles probably intervenes between the last named point and the Peace River, which I was unable to reach owing to the want of canoes and the lateness of the season. However, although it would have been desirable to complete the survey so far, it is a matter of little importance, the practicability of the lower portion of the Omenica for railway purposes being beyond a doubt. Before going farther, I shall now proceed to a description of the whole line examined, taking up each portion of the route *seriatim*, from Hazlelton eastward to Germansen Creek.

As will have been gathered from the foregoing *resume* of the season's operations, the Babine valley presents the only available approach to the Peace River Pass from Hazleton on the Skeena.

The Susquah Valley is scarcely suitable for a trunk line, while the route *viâ* the valley of the Wotsonqua discovered many years ago by the Western Union Telegraph parties, points unmistakably either to the Pine River or Yellow-Head Pass of the Rocky Mountains. Apart from the last mentioned route, there is no way south from Hazleton of reaching the Peace River, and my own explorations of this season show conclusively that from Hazleton northward to the River Babine, a high and mountainous chain blocks up any passage to the eastward; while northward from the River Babine, the only other way at all possibly available would be by the Upper Skeena, Sestout and Omenica rivers, or by Bear Lake and the Driftwood river valley, both routes by far too circuitous, and that of the Sestout probably quite inadmissible.

From Hazleton, northward, a line up either bank of the Skeena for ten or twelve miles would be perfectly feasible, the right bank being probably the easier, but above that it would, I think, be advisable to carry it along the left bank, which offers greater facilities for a road. From Hazlelton to the mouth of the river Babine there are seven or eight ravines varying in depth from 100 to 150 feet, to cross which lofty structures would be required, although, of course, much would depend upon location, a shore line not requiring such expensive bridges as one some distance back from the river, which, on the other hand, would possess material advantages in considerable stretches of level terraces. From Hazleton to the mouth of the River Babine the general course of the Skeena is nearly due north, the distance 33 miles, and difference of level 350 feet, the gradients in general being light. In this distance the Skeena washes the western bases of the mountains contained in the triangular area bounded by itself, the Babine River, and the valley of the Susqua, a mountainous agglomeration of snow clad peaks covering at least 350 square miles. Twelve miles above Hazleton the valley of the Skeena contracts to some extent, and the river is frequently confined within narrow canons. The banks are generally abrupt, and vary considerably in height, the terraces, when they occur, being sometimes 150 feet above the river level. In the canon portions a line would, in most cases be carried some distance back, and upon the whole, it may be stated that the works in this valley would *undoubtedly* be as heavy as upon many portions of the river between Kitsellasse Canon and Hazleton.

The lower portion of the Babine River valley contrasts very favorably with that of the Skeena, wide and level benches or terraces covered with luxuriant vegetation, extending from the confluence of the two rivers to the upper village at the 40th mile.

At the 37th mile, a very rapid stream of glacial origin, coming from the south, enters the Babine. The level bench upon which stands the upper village of Kiskargasse, is about 600 feet above the level of Hazleton, which is *assumed* to be 725 feet above sea. A line should, however, cross the Babine River at the lower village, or say at the 38th mile, and thence ascend the right bank of the river upon the high terrace, past the upper village, and thence up to the 60th mile, whence it would gradually increase its distance from the river, and take a northward course across the table land between the Babine and Neelkitquah Rivers, into the valley of the latter. The summit of the table land at the base of the isolated Mountain is about 2,300 feet above Hazleton, the general gradients from Kiskargasse to this point *probably* not exceeding 1.5 per 100. Some distance above Kiskargasse the terraces disappear, wooded slopes taking their place, while the river flows several hundred feet below, but the hillsides being gentle, and heavily timbered from wateredge up, and for miles back to the mountains, no great difficulty is anticipated. Several streams have to be crossed, notably, the rather formidable torrent over which we built a bridge on the 8th July, on our way to Bear Lake.

The valley of the Neelkitquah is favorable for a railway from the 70th mile up to the confluence of a tributary from the Kotsine Summit; the banks are of moderate elevation and the adjoining ground is tolerably level. At about the 77th mile the line takes a north and east course up the valley of the tributary coming from the Kotsine Summit, which is reached at the 83rd mile from Hazleton. Here, there is a gap in the central range at the western base of which the Neelkitquah flows. The rate of ascent from our canoe camp to the summit was rather more than 2 per 100, but by keeping well up on the high ground from about the 75th mile, so as to enter the pass at an elevation of 150 feet above the level of the Neelkitquah, the gradient may be very much lessened.

The elevation of the Kotsine summit (*the highest point on this route*) is, accurately, 2,875 feet above Hazelton, approximately 3,600 feet above sea level. The pass is favorable. A mile or more on each side of the summit it is of a level, swampy character, and in the narrowest place the mountain bases are nearly a mile apart. On the south side the mountains rise to high elevations, being probably 3,000 or 4,000 feet above the eye. The River Kotsine rises in the mountains a little to south and east of the summit, and after an easterly course of about twelve miles enters the Driftwood River in latitude 55° 48'. The line does not follow the Kotsine very far, but trends south-eastward towards the upper end of Lake Tatla, with the two fold object of lessening the down grade into the Driftwood River Valley, and of following a direct course to Buckley House. At the 93rd mile the line crosses the Kotsine Sitlica, a tributary to the Kotsine, and at the 101st mile the Driftwood River is reached. The crossing here would probably be about 1,600 feet above the level of Hazelton. From the Kotsine summit to the Driftwood River the grades will likely be heavy; in any case they will be from the Kotsine Sitlica to the Driftwood, the last eight miles probably requiring a gradient of 2 per 100. Crossing the valley of Lake Tatla, and passing the site of Buckley House at the 105th mile, the line would ascend the southern slopes of the Omenica range in a diagonal direction to the summit of the Hogem Pass at the 118th mile. The elevation of this summit is, accurately, 2,713 feet above Hazelton, 1167 feet above Lake Tatla, and, approximately, 3,438 feet above sea level.

It is hoped that by crossing the Driftwood River at a high level, say 75 feet above that of Lake Tatla, and keeping well up the slopes to the east of Buckley House the "Hogem" Pass may be reached with gradients not exceeding 1.5 per 100. In all the distance from Buckley House to the summit, the mountain slopes are quite gentle and covered with forest, one or two streams running through lateral ravines alone presenting obstacles of any magnitude; it is also probable, that, in order to keep down the grades, a large amount of earth excavation through the summit swamp will be necessary. In every respect the eastern ascent from the valley of the Driftwood will be much easier than that towards the Kotsine summit, and in both approaches to the low level of Lake Tatla, it will probably be more difficult to confine the grades within reasonable limits than on any other portion of the route between Hazelton and the Omenica (the valley of the river Babine perhaps excepted). As matters are, those passes and their approaches are very much better than could reasonably have been looked for.

From the "Hogem" summit, the descent, through the valley of the Fall River to the Omenica, is comparatively easy, the gradients being in general moderate. In one or two places, however, short, stiff grades of 2 per 100 may be found unavoidable, notably between the outlet of Second Lake and Beaver Creek, and again between the 133rd mile and the 134th mile. In all other respects the Fall River Valley is exceedingly favorable.

"Old Hogem" at the 143rd mile and on the right bank of the River Omenica, is 1,845 feet above the level of Hazelton or, approximately, 2,570 feet above sea.

Some years ago, when the Omenica gold diggings sprung into existence, what is known as "Old Hogem" was the site of several trading stores, and a sort of rendezvous for miners and others similarly interested. To-day a ruined shanty is all that remains of it.

The splendour and glory of "New Hogem," situated ten miles further down the river, appear to have been of an even more evanescent nature, for its site is only recognizable by about an acre of stumps, the sole vestige of man's former presence. And yet, but a few years ago, both places were busy haunts. Now they are howling wildernesses, although, even to-day, men occasionally pass up and down the Omenica with supplies for the much impoverished gold mines of Manson and Germansen Creeks, where, perhaps, a couple score of miners eke out an existence and, with very few exceptions, barely manage to keep out of debt. Old Hogem is about 3 miles below the mouth of Fall River. Silver Creek falls into the Omenica about a mile below. From Fall River to Germansen Creek, at the 168th mile, the valley of the Omenica is favourable for railway construction, in fact by far the most favourable portion of the whole route examined. The valley is wide, probably averaging a mile, and the descent so gentle as, not in all probability to exceed 5 or 6 feet per mile.

Between Fall River and Germansen Creek, where the elevation of the Omenica is approximately 1,732 feet above Hazelton, or 2,457 above sea, the distance is nearly forty miles by following the sinuosities of the Omenica which is continually changing its channel, the low sand and gravel banks, between which it flows, readily giving away to the impetuous but smooth current.

The valley of the Omenica is very beautiful, and the mountains which hem it in on each side, although, in one or two cases, of considerable elevation, do not possess the barren, wild appearance so characteristic of the snow-clad peaks of the Skeena and Babine country. In fact, from Lake Tatla eastward, a change in the general aspect of the country is quite apparent. Lake Tatla also appears to mark a change in the geological formation, gold-bearing slate being predominant on its east side, as it is also, I believe, over a considerable extent of the region to the eastward, as far as the Rocky Mountain chain. As has already been remarked, the survey was not carried east of Germansen Landing, but there is no reason to doubt the favourable character of the Omenica between Germansen Landing and the mouth of the Findlay River.

Below Germansen Creek the Omenica preserves a nearly placid course through a wide valley, for 15 or 20 miles, after which it becomes rapid, and a canon, formidable enough in high water, but passable for the frailest canoe when at a low stage, intervenes. This is the "formidable" Black Canon of Butler's "Wild North Land." A miner informed me that he had ascended from the Findlay branch to Germansen Landing entirely alone in a very small canoe, and that the canon walls are not high, probably not more than 75 feet, with ample room on either side for road purposes. Below the canon, as the Findlay mouth is approached, the country is of a very low and level character. It is therefore quite apparent that no obstacles of any importance would be met with.

As regards the question of grades in this unexamined portion of the Omenica, it has been seen that, at Germansen Landing the elevation is 2 457 feet above the sea. Now, assuming the level altitude of the Peace River at the Findlay branch to be 1,700 feet above sea (and I think this to be an under-estimate), we obtain a difference of level equal to 757 feet which, evenly distributed throughout the intervening distance, gives a very moderate inclination, say of 15 feet per mile, so that upon this score there can be very little room for doubt.

The foregoing description will be better understood by reference to the accompanying profile and plan, the latter drawn to the scale of $\frac{1}{96000}$, or 8,000 feet to an inch, which shows a very large portion of hitherto unknown country, and extends, north to south, from Bear Lake in latitude 56° to Lake Trembleur in latitude 54° 52' (otherwise known as Cross Lake), and from Hazelton to Germansen Creek over three degrees of longitude. Upon the profile exhibited, the distance from Fort Simpson to the head of the Rocky Mountain Canon of the Peace River is 483 miles.

It is also worthy of remark that, on the existing maps of British Columbia, the portion of country examined by me this season has been erroneously laid down as to latitude, the true positions of Bear Lake, Buckley House, and Trembleur Lake, being from 10 to 15 minutes of latitude more to the north than they are thereon shown.

Before bringing this brief description to a close, it may be well to add that Indian report points to a vast extent of fine prairie country immediately to the northward of Fort Connelly, which is also said to extend eastward to the upper Findlay River, and northward, never so far. It is much to be regretted that circumstances forbade any attempt to see even the slightest portion of this interesting region, which, if its existence be real, presents a strange anamoly in such a mountainous country.

During my visit to Manson Creek, I also learned from a miner who ascended the river Findlay some years ago, that it is a magnificent stream, almost lacustrine in character for many miles, with low, level banks, and flowing majestically through a wide valley at the western base of the Rocky Mountain Chain. Its upper branches drain the prairie region above referred to.

Throughout the whole distance from Hazelton to Germansen Creek, the route found has been traced through a densely-wooded region. On the western portion, *i.e.*, from Hazelton northward, and well up the valley of the River Babine, the forest, owing to the humidity of the climate, is almost entirely green, but beyond the central range, large areas in the Driftwood, Fall River and Omenica River valleys have been denuded by fire. The forest of this northern region does not present a great variety of woods—the principal are the spruce fir, the Banksian pine in the dry localities; cotton wood and aspen along the rivers and lakes. A few birch trees were seen in the vicinage of Lake Tatla, and there I saw, much to my surprise, a veritable birch bark canoe, the property of an Indian.

The spruce fir is, however, more universally distributed through this mountainous region than any other wood. Wild fruits are plentiful, and the numerous streams teem with fish.

A very large portion of the country seen is quite unsuitable for agriculture, the causes being in certain localities, great elevation, in others want of good soil and severity of climate, or, properly speaking, the short duration of summer. I fear, indeed, that from this cause the cultivation of any but the hardiest cereals will be impossible, although it is difficult to say what effect might be produced by clearance and settlement. At Bear Lake, scarcely any attempt has hitherto been made to cultivate more than a few potatoes and garden vegetables, and even those have not proved a success; still, I believe that with proper care, good barley and potatoes might be grown there.

At Lake Babine some potatoe patches were completely frozen about the beginning of August; this was, however, in a great measure due to the too close proximity of the garden to the lake. In a higher location this accident would, in all probability, not have occurred. During the month of August severe nocturnal frosts were of frequent occurrence in the valleys of the Babine and Nalkitquah Rivers. It was, however, remarked that on the uplands vegetation never suffered from that cause to such an extent as in the close, deep valleys occupied by water. On the 21st of August the cold was so great as to form ice a quarter of an inch thick at my canoe camp on the River Babine. while 400 feet higher, on the table-land, the wild fruits were scarcely touched by frost. I observed, as also did Mr Macoun, this phenomenon on the Peace River in the autumn of 1872. It is easily explained: the uplands enjoy during the day a greater portion of sunlight than the valleys, and moreover the winds exercise a heating influence over the soil and vegetation, while they often fail to reach the valleys at all, where the undisturbed and stagnant atmosphere predisposes to frost.

At Hazelton, on the Skeena, during the month of July, great vicissitudes of temperature were observed, intense heat prevailing during the day, while at night the minimum thermometer fell very low indeed, and on the 31st of July is recorded "fresh snow on the mountains," an observation which however deserves no special notice, the same phenomenon taking place all the year round at intervals, throughout the length and breadth of the province.

In the Ominica quarter, and in the valley of that river, during the month of September, very cold and frosty weather was experienced. On the 21st of September the poplar foliage was of the deepest yellow, and the autumn was, I should say, at least one month in advance of our usual experience in the valley of the Ottawa.

While on the subject of climate, I may mention that the meterological observations of this summer, undertaken chiefly for hypsometrical purposes, are now being tabulated with the view of obtaining some insight into the climatic conditions of this region.

After the termination of the season's work, I sent my men back to the coast *via* the Skeena River, merely reserving a couple to accompany me on my way to Quesnelle, which was reached, *via* Stewart's Lake, on the 12th October. During my way down, I made a micrometrical survey of the east shore of Lake Tatla and of a portion of Middle River.

An examination was also made of the southern end of Lake Tatla, having in view a possible line from St. John's Bay on Lake Babine.

In 1872 I reported that the chain of lakes lying immediately to the eastward of Lake Babine presented a favorable opportunity for the passage of a railway from the direction of the outlet of Lake Babine, and that the wooded hills which flank St. John's Bay on the east might in all probability be scaled by a railway. During the past season Mr. Cambie, on his way up Lake Babine, walked up the trail which crosses those hills, and found by aneroid that the elevation did not exceed 1,000 feet, and that those hills are quite practicable. Such being the case, I examined, as already remarked, the southern end of Lake Tatla in this connection.

To the eastward of the southern end of Lake Tatla the country appears low although still very much broken. There may be some direct passage thence to the Nation Lakes, but I am inclined to think that a more favorable line would be found by following the Middle River to Lake Trembleur, and skirting its northern shores to the low valley of a small stream which falls into Lake Trembleur at its eastern extremity. Thence I believe a passage might be found towards McLeod Lake. After a very careful study of this northern region, I am more than ever convinced that the route *via* the Kotsine Pass is the only available one from the Skeena to the Peace River Pass of the Rocky Mountains, and that the southern one *via* the Tatlabunkut chain of lakes, the pass opposite Fort Babine, and Middle River towards Lake McLeod, which lies probably seventy-five miles due east from Lake Trembleur, would only be useful in connection with the Pine River Pass to which I drew the attention of the Government in 1872.

The meteorological observations made during the past summer, disconnected as they unavoidably were, are unsatisfactory as data for arriving at more than a rough estimate of the climatic conditions of the region so hastily examined. Nevertheless, it may be remarked that the register shews some interesting thermometrical differences which I shall give here. Simultaneous hourly readings during the month of July shew a difference of four degrees of Farenheit between Hazelton and Lake Babine, the former assumed to be 725 feet above the sea, the latter 1,647 feet higher. The higher temperature occurs at Hazelton. Similar readings at Lakes Babine and Tatla show differences of 3 degrees of Farenheit, the higher temperature being at Lake Tatla.

The climate of Bear Lake for a few days in July, as compared with that of Hazelton, is in like manner, shewn to be seven degrees colder.

The most genial climate seems to obtain at Lake Tatla, and I may here remark that, in my opinion, the most fitting area for settlement or agriculture seen during the season is in the trough of the Driftwood River and Lakes Tatla, Trembleur and Stewart, where a considerable extent of fine land is to be found in spots. I have no doubt that there are also a few favorable localities on Lake Babine, as there are in the vicinity of Hazelton and Kyspyox, but elsewhere, with scarcely any exception, the country is of too elevated and mountainous a character to be at all fit for agriculture.

I have the honor to be, Sir,
Your most obedient servant,
C. HORETZKY.

SANDFORD FLEMING, Esq.,
Engineer-in-Chief, Canadian Pacific Railway,
Ottawa.

# APPENDIX No. 6.

## MEMORANDUM REGARDING A JOURNEY FROM VICTORIA, V.I., ACROSS NORTHERN BRITISH COLUMBIA, *vid* PEACE RIVER PASS, TO EDMONTON, BY THE REV. D. M. GORDON, B.D.

In company with Messrs. Cambie and McLeod, of the Canadian Pacific Railway Survey, and Dr. G. M. Dawson, of the Geological Survey, the writer left Victoria on Tuesday, 3rd June, 1879, by steamer "Olympia," (since called the "Princess Louise,") commanded by Captain Lewis, who is regarded as the most experienced navigator of the Canadian Pacific coast.

After steaming through the Straits of Haro we passed northward between Vancouver and the smaller islands that stud the Straits of Georgia, until, leaving the northern extremity of Vancouver, we entered the series of channels that divide the mainland from the long succession of islands which fringe the coast with scarcely any interruption as far as Alaska. This land-locked strip of ocean that stretches almost unbroken along our Pacific coast from San Juan to Port Simpson, is one of the most singular water-ways in the world. On the western shores of Vancouver and of the chain of islands lying to the north the waves of the Pacific break with an unceasing roll; but here, inside the breastwork of islands, and between them and the mainland, the sea is commonly as smooth as a canal. It is deep enough for the largest man-of-war, even within a short distance of the shore, and yet the tiniest steam-yacht runs no risk of rough water. For pleasure-sailing this deep, smooth, safe, spacious, land-locked channel, or series of channels, is probably without a rival. Now it broadens to a width of several miles, and again it narrows to a span of a few hundred yards, the number of islands enabling one to shape his course over calm water in almost any weather, while on every hand one is girt by varied and attractive scenery. For commercial purposes, when the mines along the eastern seaboard of Vancouver become more fully developed, and the coasting trade increases, the value of such water communication, possessing all the advantages of deep-sea navigation, yet protected by a line of breakwaters from all the dangers of the sea, can hardly be over-estimated. Only at two places is it exposed to the gales of the Pacific, and there only to those from the west, viz., from the north end of Vancouver Island as you round Cape Caution, a distance of about thirty miles, and again for about ten miles when passing Millbank Sound. At two places also, Dodd's Narrows, near the entrance to Nanaimo, and at Seymour's Narrows, between Vancouver and Valdes Islands, there is, at certain conditions of the tide, a strong current, sometimes from four to eight miles an hour, which might cause delay for two hours at the utmost to an ordinary steamer. For the rest there is no more difficulty than would be met with on a deep, unruffled lake. The discomfort to which the traveller along this coast is most exposed is the moist climate, which prevails when you pass beyond the protection of the mountains of Vancouver. Until you approach the northern extremity of that island its lofty hills, some of which are over seven thousand feet in height, intercept the showers that drift landward from the Pacific, so that these fall on the western slopes of the island. Hence the eastern coast from Victoria northward enjoys a most delightful climate. But when you have passed Vancouver the islands to the north no longer serve in the same degree to intercept the clouds. These roll inland until they strike the lofty slopes of the Coast or Cascade range, which runs close to the seaboard along its whole length, and hence the northern part of the coast enjoys—or rather endures—a much greater rainfall than either the east coast of Vancouver Island or the southern portion of the mainland.

Beyond the shelter of Vancouver the weather became, as we had expected, decidedly moist. A drizzling rain obscured, for the time, our views of what, from occasional glimpses, we inferred must be magnificent scenery. When the leaden mist would lift we could see the hills, now bare and precipitous, now wooded and sloping, now torrent-carved and snow-capped, sometimes like a wall of adamant defying the waves, and again cleft by deep narrow fiords or gorges.

On Thursday, about noon, we reached Port Essington at the mouth of the Skeena, a distance of about 450 miles from Victoria. The village consists of some fifteen or twenty houses, the best of which is occupied by the solitary white trader of the place, the others by Indians. The chief staple of trade, which is also the chief article of food, is salmon, for here as elsewhere along the coast, salmon is found in extraordinary abundance, and during the fishing season there is a ready market for them at the small cannery, a little north of this, known as Willaclach, called also Woodcock's Landing, or Inverness. There is very little land in the vicinity fit for cultivation, the country being for the most part rugged and mountainous; but there are excellent cedar forests close at hand, a fact that induced an enterprising firm to build a steamer here some years ago, as it was possible to bring the engines, &c., here more easily than cedar could be conveyed to Victoria, but the price of labour made the venture a costly and unsuccessful one.

For some distance from the mouth of the river the clear sea-water is discoloured by the dark waters of the Skeena; indeed, the river seems to push back the sea rather than to blend with it, for although there are the usual tidal variations, exposing at low water a rough beach in front of the village, yet the water near the shore is almost perfectly fresh, and is constantly used for cooking and other domestic purposes. The large bay that receives the waters of the river affords good anchorage, but it cannot be called a good harbour, for not only is the access from the sea somewhat intricate, but during the winter season it is blocked with ice brought down by the Skeena. Adjacent islands prevent the waters of the Pacific from having much effect upon the bay, except in the rise and fall of the tide, and as it receives the waters of a large river that in winter are ice cold, and frequently blocked with ice floes, this bay, unlike the great majority of the bays on the Pacific coast, is ice-bound for a part of the year.

From Port Essington we steamed on to Port Simpson, about 50 miles further north, visiting on our way the Indian village of Metlahkatlah, in order to secure crews and canoes for our journey up the Skeena. Metlahkatlah is chiefly known through the remarkable mission established here, in connection with the Church of England, by Mr. Wm. Duncan. Other missions to the Indians, both Protestant and Roman Catholic, exist in British Columbia, but it is no disparagement to them to say that none of them have proved so successful as the mission at Metlahkatlah. The Tsimpseans, as the Indians of that district are called, were at the time when Mr. Duncan came among them, seventeen years ago, as fierce, turbulent, and unchaste as any of the other coast tribes, not excepting the Haidahs; whereas now the chastity of the women, the sobriety and steady industry of the men, the thrift and cleanliness of all render their settlement the equal, in these respects, of almost any place of the same size in the eastern provinces. Mr. Duncan desired from the first to draw in the Indians from scattered districts along the coast to one centre, a plan which might work well in this quarter where the Indians live chiefly by fishing, although it could not be carried out in the same way among the Indians of the woods or of the prairies, who live chiefly by hunting. He chose as the centre of operations the little Indian village of Metlahkatlah, where at that time about fifty persons were living, and he has already gathered around him Indians from adjacent districts to the number of about a thousand, upon whom he has been able to exert a strong and steady influence. He learned their language, made it a written language, and now teaches it to them grammatically, while instructing them also in English. He learned several trades that he might instruct them, and sent some of them to Victoria to learn trades that they might in turn become artisan teachers. The fruits of their labour, beyond what are required for their own maintenance and comfort, are exchanged for such commodities in the way of clothing, provision, etc., as they can procure from Victoria, and these are furnished at an excellent shop in the village, which, under the missionary's direction, is managed by Indian clerks. A large and beautiful church, a commodious school-house, an extensive trading store, comfortable dwellings, a saw-mill, and numerous workshops are among the outward and visible evidences of the success of the mission. We engaged two crews here, and found them to be excellent fellows, active, honest, and kindly; they were accustomed each evening to have prayers in their own language, and the man who led their devotions was the bravest, best-tempered, and most skilful boatman of them all.

On account of our delay at Port Essington and Metlahkatlah, we did not enter the harbour of Port Simpson till daybreak on Friday, the 7th.

Port Simpson is a small village that has gathered around an old Hudson's Bay Company's post (from which it is sometime called Fort Simpson), and is occupied almost entirely by Indians. The harbour is most favourably situated. Easy of access for steam navigation, through the channel by which we entered it from the south, it is easy of access for sailing ships or steamers approaching from the west, through Dixon Straits, that separate the Queen Charlotte Islands from Alaska; and it is as safe as it is accessible. Facing the west it has two approaches—Dodd Passage, between the south-western extremity of the harbour and a reef of rocks, and Inskip Passage, which separates this reef of rocks on its northern side from Birnie Island. Between Birnie Island and the northern extremity of the harbour, there is a choked passage not fit for any navigation, save that of canoes or other light craft. This reef of rocks, though hidden at high tide, is traceable at low water on account of the kelp attached to it, and it serves as a partial breakwater for any sea that might roll in from the Pacific, while Birnie Island completes the protection of the harbour on the western side. The extent of the harbour may be set down at not less than three miles in length, with an average breadth of nearly one mile. Its only exposure is to the west, especially through the approach known as Inskip Passage, but no severe gales ever visit it from that quarter. Finlayson Island and the Dundas Islands protect it to the south-west and south, while any gales from the north-east, east or south-east (the prevailing quarters for high winds in this locality) can scarcely have any influence on its waters, as it is so well defended on these sides by the high surrounding land. The anchorage is reported by Captain Lewis to be excellent.

From Port Simpson we visited Work Channel, an inlet of 32 miles in length, which runs from Cape Maskelyne, five miles north of Port Simpson, in a southerly direction, making a peninsula, known as the Tsimpsean Penisula, of an average breadth of twelve miles. from near the mouth of the Skeena to Cape Maskelyne. This channel has never been fully surveyed. It seems to be similar to many others of the deep inlets, that run into the mountains along this coast and that have often been likened to the fiords of Norway. The north-easterly bank is more precipitous than the other, the hills rising for the most part very steep and abrupt from the water's edge, and although almost uniformly covered with a growth of small cedar, yet when occasional snow-slides or perpendicular bluffs disclosed their rocky character, it became a matter of surprise how anything could grow upon their surface. About 22 miles from the entrance the north-eastern bank is cut through by a narrow fiord called Quatoon Inlet, where the bare rocks seemed to yawn in order to allow a glimpse of some snow-capped summits and rugged cliffs, more imposing than the scenery at any other part of the channel. At the head or south-eastern extremity of the channel a stream enters from the south; up the valley of this stream there is a pass at low altitude, connecting, by a few miles, Work Channel with the River Skeena.

The south-westerly bank is not marked by hills of the same precipitous character as those on the other side, except for two or three miles from a point opposite Quatoon Inlet, towards the head of the channel. Here the descent to the water's edge is very abrupt, although, even here, there is an almost unbroken growth of small cedar, with occasional patches of cottonwood in the rifts between the hills, as fully advanced in leaf, at the time of our visit, as the cottonwood trees near Victoria. For the rest, the slopes along the south-western bank are gentle, and frequently terminate in a ledge or bench of some considerable width, about forty feet above high water.

As we were returning to Port Simpson, and when half-way down Work Channel, the drizzling rain, which had fallen more or less steadily since Wednesday morning, ceased, the clouds broke away, the sky grew clear, and the day became bright again as an English May-day. Steaming around Cape Maskelyne, we could see along the coast of Alaska for many miles, and as we turned south and passed Port Simpson, the harbour and its surroundings appeared much more attractive than they had done in the disagreeable drizzle of the morning. The sea was calm, and as the afternoon wore on, the day continued bright, while we held on our course for Port Essington. It seemed as if this northernmost portion of the Pacific coast was as fair and favourable, in regard to scenery and climate, as the coast of Vancouver, or of the southern portion of the mainland; and yet the testimony of all whom we met, capable of giving evidence, tends to prove that the climate here is exceedingly moist. Mr. Duncan, of Metlatkatlah, kept a record of climatic changes for one season of seven months, from October to April, and found that only an average of seven days per month were fair; and after a residence of [illegible]teen years in this locality, he thinks that this is a reliable proportion for that part of the year, but that the proportion of wet weather, during the remaining months, is not so large. During one season, in which he was teaching night school, it was necessary for him, each evening, to carry a lighted lamp from his house, a few steps from the school; and he observed that for twenty-one consecutive nights, he required to carry an umbrella over the lamp to protect it from the rain. Mr. A. McAlister, who built a steamer at Port Essington, an intelligent and reliable witness, says that sometimes in July there is fine weather, but little during the rest of the year. Capt. Lewis, and residents at Port Simpson, give similar reports, and yet from our own experience of what is accepted as "wet" weather, it is not heavy rain that prevails here, but rather light and frequent drizzle, with cloudy skies, like that which one experiences so often on the west coast of Scotland. At any rate, whatever be the extent of the rain fall, the climate seems to be a healthy one, if we may judge from the fresh and vigorous appearance of the people; and those resident here say that the cold is not more severe than in the southern parts of the Province. Fogs are not very frequent, not much more so than at the lower end of the Straits of Georgia, while the dense smoke from bush fires, of which pilots further south sometimes complain in summer, is quite unknown here.

Around Metlahkatlah as well as around Port Simpson, some attempts are made at gardening; vegetables are grown with fair success, especially potatoes, but the soil near the sea is for the most part boggy, while further from the shore it is rocky; in either case, with the exception of a few occasional patches it is said to be utterly unfit for cultivation. There is a good deal of timber, particularly red and yellow cedar (the so-called yellow cedar being, more accurately, cypress), and some trees grow to a large size, but they are not much used except by the Indians for producing sawn or hewn boards of which they generally build their houses, or for making their canoes, which are simply logs of cedar, dug out and shaped to the required model. Beyond this there is at present no market for this timber, which appears to be the only valuable product of the soil in this part of the Province, the wealth of the district being rather in its extensive fisheries of seal, sea-otter, salmon, halibut, whale, herring' etc. There are very few settlements, and few inducements for settlers. The whole country seemed to be wrapped in silence, with scarcely a sign of life, except some salmon-canning establishments or a few Indian villages that have grown up in localities well favoured for shooting or fishing, or that have clustered around the posts of the Hudson's Bay Company.

We left Port Essington on the 7th June, our proposed route being up the Skeena to the Forks, thence across the country, to Babine, up Lake Babine, down Lake Stewart to Fort St. James, the central Hudson's Bay Post of northern British Columbia. From Fort St. James we would follow the trail to Fort McLeod, and thence proceed by boat, canoe or raft, down Peace River through the

Rocky Mountains to Dunvegan, and, after spending some time in the Peace River country, hurry eastward by way of Edmonton to Winnipeg.

By observations made in part by micrometer and in part by track survey, the distance from Port Essington to the village of Hazelton, better known as the Forks of Skeena, or by its Indian name Kitunmax, is 150 miles; this may be regarded as, at least, approximately correct. The altitude of Hazleton above the sea is about 650 feet. Ordinary tide water reaches about 22 miles above Port Essington; spring tides are felt several miles further.

The current is always strong above tide mark, 'and sometimes very rapid, there being scarcely any reaches of calm water, so that "poling" and "tracking" are frequently required.

For some distance from the mouth of the river, say 50 miles, the banks on both sides are steep, sometimes almost precipitous, but along the greater part of this distance, especially on the northern or right bank of the river, there runs a flat or low bench of varying width, while at the same time the river is so shallow near the shore as to admit of poling almost without interruption. When the tide is out the beach is exposed for a considerable width along the lower portion of the river. On the bluffs and high hills, visible from the river, the effects of snow-slides and land-slides may occasionally be observed, coming in a few instances even to the water's edge.

In 1866 the steamer *Mumford* ascended the Skeena about 70 miles, to a point a little above the village of Kitsumgallum. This point is regarded as the head of steam navigation, as any navigable stretches of water above this are interrupted by heavy rapids. The *Mumford* was employed by the Western Union Telegraph Company of the United States to convey supplies for the men who were engaged on the line that had been projected through part of British Columbia. That company commenced explorations in 1865, with a view towards the construction of an overland telegraph, which, by way of Behring Straits, was to unite the Old and New Worlds, but after the expenditure of three millions of dollars the scheme was abandoned owing to the success of the Atlantic cable. For about 80 miles from the coast the Skeena is dotted with islands that have been formed by rich alluvial deposits borne down by the stream, and that are now covered by a luxuriant growth of timber, chiefly of cotton wood, while the banks of the river are fringed in many parts by flats that are also densely wooded. In some instances the islands are so near the shore that the channel between them and the bank might, if any good purpose were to be served by it, such as the reclamation of land, be very easily filled and the water diverted into the main channel. As the river cuts its way through the Cascade Range, which is here more Alpine in character than the range of the Rocky Mountains in the same parallel, we were frequently in the midst of wild and attractive scenery. The hills are lofty, serrated, snow-capped; sometimes we could see a glacier, enclosed in a shell-shaped valley and surrounded by an amphitheatre of peaks; while the wooded islands and flats, in their varied shades of green, form a pleasing foreground for every view.

Occasionally we passed an Indian village, consisting of a few rude houses made of rough cedar boards. Each house accommodates two or more families, and in some of the villages each house is adorned by a curiously carved door-post. The figures ingeniously cut upon these door-posts are supposed to be the heraldic bearings of the family, but to the uninitiated the heraldry of these Indians is as mysterious as the heraldry of the English nobility. Frogs, bears, beavers, whales, salmon, seals, eagles, men, sometimes men tapering into fish like the fabulous merman, are the figures most frequently seen. Several of these may be found on each post, the post being about thirty feet high, and two feet in diameter at the base. In many cases more labour is expended on this post than upon all the rest of the house; sometimes it is large enough to admit of a hole being cut through it sufficient to serve as a doorway, and in this case the opening is usually by some quaint conceit made to represent the mouth of one of the carved figures; frequently, however, it is quite distinct from the house, standing in front of it like a flagstaff. Not far from the village may usually be found a little graveyard with carved and painted monuments, but very often the grave of the Indian is separated from the graves of his kinsmen, and is commonly marked by his canoe or his gun, or, in the southern part of the province, by the hide of his horse, his own remains being enclosed in a rough box, laid sometimes upon the ground, sometimes interred a few feet. Among some of the Skeena Indians the remains of the dead are cremated, the charred bones and ashes being placed in a box which is left exposed near the outskirts of the village.

Near almost every village we found men engaged in fishing, for, as we passed here about the middle of June, the first run of salmon had already commenced, and salmon being abundant in the Skeena, as in every other river of British Columbia, is the staple, almost the exclusive, article of food among the Indians. When the salmon fails, as it has sometimes done, the distress and destitution are very great, for the natives seldom raise any kind of vegetables, the character of the country, as well as of the people, being adverse to agriculture. When, however, the salmon can be taken in the ordinary abundance, a man may in less than a month lay in his supply of food for the year.

Advancing up the river there is an increasing proportion of plateau or flat along the banks, occasionally, though not often, interrupted by ledges of rock, and almost invariably where such flats are not found, the hills slope gently towards the water.

The mountains between the coast line and the Lakelse Valley, which joins the valley of the Skeena about 75 miles from Port Essington, are not so lofty nor so marked by peaks and serrated ridges as those that become visible on further progress into the interior. Indeed, a general depression may be traced, in a direction somewhat similar to that of the coast line, along the valley of the upper waters of the Nasse and by the streams and lakes which, at Kitsumgallum, connect it with the Skeena, thence by the Lakelse Valley to Kitimat on the northern arm of Gardner Inlet. This depression is not clearly indicated on any published map of British Columbia; it cannot properly be called a valley, but if we may suppose the general level of the country to be lowered 1500 feet (and the average level of British Columbia, exclusive of the Peace River country, is estimated at 3,000 feet above the sea), there would be traceable among the remaining elevated ridges, a valley or chain of valleys in the direction indicated. Through this Lakelse Valley there appears to be a pass at a comparatively low altitude, connecting the waters of the Skeena with the waters of the Pacific at Kitimat on Gardner Inlet.

Throughout the course of the river, abundance of timber is found along the flats and the lower slopes of the neighbouring hills. Cottonwood grows to a large size on the islands; spruce, sometimes as much as six feet in diameter, hemlock of a superior size and quality, cedar and aspen abound, and less frequently Douglas pine, birch and mountain ash. The flats are usually rich with peavines or vetches, strawberries, raspberries, gooseberries and with a great variety of wild flowers, such as the rose, columbine, linea, violet, anemone, saxifrage, etc.

There is scarcely any land on the lower part of the river fit for cultivation, as the islands, although rich, are apparently liable to inundation, and the flats along this part furnish little more than occasional patches suitable for the growth of potatoes. Above Kitsilas, however, *i.e.*, from about 90 miles above Port Essington the flats or plateaux are larger, more elevated and more unbroken. They are of a light, sandy loam, covering a sandy soil about two or three feet in depth upon a gravel bed, and wherever they have been cultivated, as at the scattered Indian villages along the river side, they seem to yield good crops, especially root crops. From Kitwongah to the Forks, on the north side of the Skeena, a distance of about 21 miles, there is an almost continuous stretch of plateau and apparently a valley running in an almost direct line between these two places, some distance back from the valley of the river. The district enclosed between these two valleys, with the exception of a hill rising out of the centre of it, seems to be suitable for cultivation throughout. Around the Forks there is evidently a good proportion of cultivable soil, although at present there is but a small amount of it under crop. Near the village there are several fairly tilled fields, and for some distance around it there are plateaux similar to those already referred to. Wheat has not yet been successfully cultivated in the neighbourhood, but excellent crops of oats and potatoes are raised here. Probably this part of the country may compare favourably in respect to agricultural resources with many of the restricted cultivated parts of British Columbia, but as yet there has been very little done here by whites in the way of agriculture, and the small potato patches of the Indians do not supply sufficient data to warrant any decided opinion.

The climate of the Skeena Valley is by no means as favourable as that of the southern part of the province, yet much better than its latitude might lead one to expect. During the time occupied in our journey from Port Essington to the Forks (from Saturday, 7th June, till Saturday, 21st June, both days inclusive) we had most enjoyable weather. On four days, the 11th, 12th, 16th and 20th, we had slight rain; for the remainder, although the sky was often overcast, the weather was uniformly fine. Those resident near the coast report that in the vicinity of Port Essington there is a large proportion of wet weather, but after passing through the first range of mountains (which if not a separate range are a separate portion of the Cascade range, divided from the larger mountains of the interior portion of this range by the depression already referred to passing along the Lakelse Valley), the weather is much less moist. The snow-fall near the coast is heavy, averaging on the level, in some seasons seven or eight feet, so far as could be ascertained, but diminishing toward the interior and not exceeding two feet at the Forks. Horses have been wintered out here, although it was necessary to shovel away a quantity of snow in order that they might be able to crop the grass beneath. But although the snowfall at the Forks is light, the cold is severe, frequently falling to 30° below zero and sometimes much lower, while the thermometer rises in summer to 90° in the shade, and sometimes higher, a variation of temperature not unlike that of some parts of Eastern Ontario and Quebec, but much greater than that of the southern parts of British Columbia. Near the coast the temperature is much more equable.

On our way from Port Essington to the Forks we found that the minimum at night ranged from 37.5° to 50°, the average minimum for the 15 nights being 43.66°, while at 6 p m. the temperature ranged from 40° to 63°.

No gold has yet been found along the banks of the Skeena further than the "colour" of gold, which may be found in the sand of this, as of almost every other river in British Columbia. Near Kitzigeuchlah, about 12 miles below the Forks, we observed a vein of carbonaceous slate, with a small proportion of true coal, and coal has been found on the Watsonquah—which joins the Skeena at the Forks—about 20 miles from the Forks. Further examination may prove the existence of some valuable coal measures in this vicinity.

There are scarcely any white men living in the valley of the Skeena, there being only three white families at the Forks and one at Port Essington, with none between. The Indian population at the scattered villages along the river is very small, probably not more than 500, although at the Forks there are about 250 and at Achwilget (three miles distant) 450, while the Indians at Kispyox, further up the stream, are numerous. For a time the "Forks" was looked on as a promising village, it being the point from which a large proportion of supplies were portaged to the mining district of Omenica. Had the mines turned out as well as was at first expected, the promise of the growth and importance of the village might have been realized, but the Cassiar gold fields drew away the miners; the Omenica district was found to be scarcely worth working, and although there are still about 60 white men and 20 Chinamen there, yet they are meeting with little success and the mines of that region will probably be abandoned ere long.

Many of the Indians of this and other parts of the interior are still pagan, although an increasing number are Christians. They all seem peaceable and well-disposed, and although at times they are apt to charge exorbitant prices for their labour and to take advantage of any difficulty in which their employer may be placed, and to desert him if he does not accede to their terms, yet as they are gradually brought under Christianizing and civilizing influences, they may equal the Indians of the coast and of the southern parts of the province in settled industry, as they equal, if they do not excel them in natural ability.

There is as yet no waggon road from the Forks of Skeena to the interior, but an excellent trail, good enough for a mule train, leads to Lake Babine. This trail is a portion of the only road leading from the Skeena by Babine, the Frying Pan Pass, Lake Tatla and the tributaries of the Omenica River, to the Omenica gold fields, 200 miles from the Forks, and as the only rival route to this district from the coast is the more expensive one of the waggon road along the Fraser River and the trail from Quesnel, this trail from the Skeena is the highway for a good deal of traffic.

We left the Forks on Monday ,23rd June, with a pack train of Indians, as no mules are kept at the village. The trail led us at once to the plateau in rear of the village from which we had excellent views of the Nil-khi-aw-dah, or Roche Deboulé, Mountain (so called from a broken mass of rock at its base in the canyon of the Watsonquah) that rises about 6,600 feet above the sea.

About 2½ miles from the Forks we struck the old telegraph trail which runs through the valley of the Watsonquah, to Fort Stager about 40 miles above this, having been cut for the purpose of forwarding supplies in connection with the telegraph line that had been projected and afterwards abandoned by the Western Union Telegraph Company; after following this line for a mile our course led up the valley of the Susquah, which flows into the Watsonquah a little above the junction of that river with the Skeena, passing over low rolling hills that are separated by narrow valleys, the channels of wild and picturesque streams. On the bank of one of these streams we found a vein of carbonaceous shale, in which a small quantity of coal could be detected, another indication of the possibility of finding coal measures in this part of the country. Here and there we saw small patches that might be cultivated, and the hill slopes, where cleared of timber, abound in pea-vine, wild grass and bushes, affording even in their present condition, pasture for mules or cattle. The valley of the Susquah however is not as rich as the valley of the Watsonquah; there the grass is particularly good, but with the exception of that and of the land which we saw around the Forks, there is very little in this vicinity that is fit for settlement, and even of that portion one cannot yet speak with confidence on account of the limited efforts in the way of cultivation, and the probable climatic difficulties.

After a few miles the trail leaves the valley of the Susquah, and leads up the valley of a tributary stream, the Oo-atz-an-li. As we ascend, the views looking westwards along the course by which we had come, grow more and more attractive. On the opposite side of the river stands the Na-talt-sul, a cluster of peaks, the loftiest of which cannot be less than 7,000 or 8,000 feet in height, enclosing a small glacier in the shell-shaped valley that receives the snow and rivulets from their scarped and rugged sides. From these westward there is a range of peaks and serrated ridges along the line of the Susquah, while the view is closed by the Roche Deboulé, that stands massive and compact, a sentinel of the Skeena. Sometimes the scenery becomes Alpine in character, although it has not the sustained grandeur of the mountains of Switzerland. Any one who, from the Righi, has seen the Oberland Alps, or from the Gorner-Grat, has seen the Matterhorn, Monte Rosa, and other summits in the snow-capped group that encircle Zermatt, will seek in vain for similar effects among our Canadian Alps—at least in that northern portion which we were traversing. Farther south, along the valley of the Homathco, the Cascade Range is said to be grander than on the Skeena, while the Rocky Mountains are much higher near our southern boundary than they are near the Peace River. But the Cascades are less impressive than the Swiss Alps, on account of the distance that divides their loftiest peaks and clusters; they are not so closely grouped as their European rivals, and they lose still more in this comparison by the fact that the low ranges of intervening hills are commonly covered with burnt and branchless timber, which has in part been strown by the wind, but which, for the most part, is still standing, blackened by the flames or bleached by rain and sun, a picture of desolation without sublimity and of barrenness without relief.

We did not reach the summit between the Skeena and Lake Babine until the afternoon of Thursday, the 26th. On the way we observed a profusion of wild flowers, and on the opposite side of the Ooatzanli, some small grassy meadows. The summit is about 4,500 feet above the sea level, or 3,850 above the Forks; but about 750 feet below the summit, there is a small lake from which flow the waters of the Ooatzanli westwards, and those of a stream that flows eastwards into Lake Babine. The level of this lake, which is about 3,100 feet above the Forks, and about 1,350 feet above Lake Babine, is really the lowest altitude of the pass. The distance from this to the Forks is about 38 miles, and to the meadow that fringes Babine Lake, about seven miles.

There is a striking absence of life on these hills, except of insect life, for mosquitoes and black flies are very abundant; later on in the year bears and cariboo might be found here, but an occasional partridge is all the game to be met with at this season.

Near the foot of the hill the trail crosses the stream that flows into Babine from the small lake near the summit, and from this to the water's edge there is a meadow, fully half a mile in length, slightly wooded with groves of poplar and spruce, and rich with wild hay, vetches, &c. If the climate permitted, a good farm, or at least good grazing land might be made of this meadow, but the climate seems to be too severe for farming, and the long winter, during which cattle would require to be housed and fed, would be unfavourable for stock raising. Potatoes, oats and barley, however, are successfully cultivated around Babine Lake.

We arrived at the lake on Friday, the 27th, but were not able to leave until the following Monday, as a strong wind, accompanied by occasional showers, for a time prevented us from venturing in the cottonwood canoes which are the only method of conveyance on the lakes of the interior.

During this delay we were able not only to arrange for crews and canoes to take us to the head of the lake, but also to examine some of the surrounding country. The lake discharges its waters into the Skeena by the Babine River, which flows in a north-westerly and westerly course. We could not follow it, but we learned from those familiar with it, that although its canyons are precipitious they are not very lofty, and that a winter trail runs along the benches that skirt the river. Near the Indian village, at the lower end of the lake, starts the trail to Lake Tatla, which leads over low rolling hills eastward by the Frying Pan (or Firepan) Pass, through snow-clad ranges towards Omenica, about 150 miles from Babine. This district, like some other parts of British Columbia, was almost unknown, except to Indians and Hudson's Bay Company officials, until it was explored by miners in search of gold. Gold was discovered in Omenica in 1872, and for a time the new mines attracted a good deal of attention; supplies were required, Indians were employed as porters, and times were brisk about Babine. But the glory has to a great extent departed, the mines have not realized the expectations formed regarding them, only a few of the eagar crowd are left there now; capitalists have not yet thought it worth while to begin quartz crushing, and the whole district seems to be falling back into the silence and stillness of former years.

Independently, however, of the gold-bearing deposits, there is a possible source of future wealth in the argentiferous galena of this district. As yet, this region has not been examined by any of the Geological Surveying Staff, but valuable specimens of this galena have been found, and although under the present difficulties of access to Omenica, the production of silver and lead would not be remunerative, yet if facilities for communication were increased, there might perhaps be a profitable industry established here. Occasional indications, too, of coal, or at least of lignite, have been discovered through the northern part of the Province, in rock formations, somewhat similar to those in which the coal fields of Vancouver Island are found. Therefore, although the prospects of successful farming are by no means as good as in the southern part of the Province, or in the Peace River District, yet there is some slight ground for the hope that a source of wealth may eventually be opened up in the mineral resources of the district.

We left the lower end of Lake Babine, on Monday, the 30th, and came that day 25 miles to Fort Babine, a Hudson's Bay post on the eastern side of the lake. The lake for this distance has an average width of about a mile; the banks rise very gently from the water's edge and while there is little or no marsh, there is a good deal of level and low-lying land fringing the lake. There is no timber along its sides except small poplar and spruce, and the lightly wooded slopes, backed by undulating hills, give place occasionally to large tracts of excellent pasture land. Were it not for the lofty summits that here and there stretch up in the background, one would have little idea that he was in a country that has been for the most part fitly described as a "sea of mountains."

Continuing our journey up the lake we found the scenery much the same in character as that which we had previously passed, although the banks are occasionally more precipitous, some of them being sheer and rocky. The lake stretches to a width in some parts of five miles, while near its shores there are numerous islands that increase not only its beauty but also its safety for canoe navigation. Its course is straight for about 80 miles in a south-easterly direction; then it bends abruptly in an easterly or north-easterly direction, continuing thus to the head, about 20 miles further. The upper part is somewhat bolder than that near the lower end, bluffs of granite and of marble and basaltic columns being visible at some points; but here, as further down, there is no good timber near the lake, although some large timber is to be found between the lake and the Watsonquah Valley.

On Thursday, 3rd July, we reached the head of the lake and crossed partly over the portage that connects it with Stewart's Lake, about 7 miles distant. The country between these two lakes is low-lying, undulating, with frequent pasture land, and at the head of Stewart's Lake, which we reached on Friday, there is a farm owned and cultivated by an Indian who raises excellent stock, as well as crops of hay, oats and vegetables.

On Saturday, 5th July, we sailed down Stewart's Lake in the boat of the Hudson's Bay Co., which had been sent from Fort St. James to meet us. The little stream known as the Ye-koo-tche, which flows into the upper part of Stewart's Lake, rises very near the streams that flow into Babine. The levels of the two lakes are very nearly the same, about 2,200 feet above the sea; but Babine discharges its waters into the Skeena, while the waters of Stewart's Lake flow into the Fraser, both eventually reaching the Pacific, but about 450 miles apart. To the north of Stewart's Lake there is a chain or rather a net-work of lakes, some of which discharge their waters by the Peace River into the Arctic Ocean, and some into the Pacific by the Skeena or the Fraser. Indeed, within a range of twenty miles, one can touch the waters of Lake Babine which flow by the Skeena into the Pacific, the waters of Lake Tatla, which flow by the Fraser into the Pacific, 450 miles further south, and the upper waters of the Omenica, a tributary of the Peace River that empties into the Arctic Ocean, while one small lake near Fort Connelly drains both ways, at one end into a tributary of the Skeena, at the other into a tributary of the Peace.

Around Fort St. James there is a good deal of cultivable land, while immediately in the rear of the Fort there is an excellent garden with a good variety of vegetables; but here, as elsewhere through this northern part, the summer frosts prevent the growth of wheat, although root crops, oats and barley are very successfully cultivated. Potatoes are usually planted in the first or second week in May, and the average temperature of the summer seems to be not unlike that of the Atlantic Provinces, but owing to its elevation above sea level, even more than to its northern latitude, the country in this vicinity is less promising in an agricultural point of view than some of the southern portions of the Province. Comparatively little, however, has as yet been done to determine the agricultural capabilities of this region The successful cultivation of hay, oats and vegetables at Hudson's Bay posts; the growth of good cattle at these posts, and sometimes also on the farms of Indians, who are here greatly behind the Lillooets and other Indians of southern British Columbia in farming; the wide stretches of level or gently undulating land that fringe the lakes, frequently to the width of several miles; the valleys and hill slopes covered with pea vine, wild hay and other excellent pasture; these are the most favourable features of the country from an agricultural point of view. But against these, the summer frosts and backward seasons incidental to the elevation above sea level must be considered; and yet, while this northern plateau, if it may be so called, that seems to correspond to the so-called southern interior plateau, is not as promising as many parts of the more fertile Provinces of Canada are known to be, yet it may compare favourably with some of the cultivated parts of the Province of Quebec.

Fort St. James is beautifully situated on a broad plateau, about 20 feet above the beach, at the lower end of Stewart's Lake, which stretches its waters westwards 40 miles. It has a commanding outlook, with views of scenery that remind one greatly of the Scottish Highlands. There are no snow-capped summits visible, but, look in any direction you may, there is a background of hills that in some parts border on the lake, and in other parts are separated from it by wooded plateaux or by gently undulating slopes that enhance the varied beauty of the scenery, while, under the prevailing westerly winds, the waters of the lake break upon the beach with the musical monotone of the sea.

We reached the Fort on the day on which, when leaving the coast, we thought we might possibly do, if we were favoured by weather and by absence of unforeseen accidents. The distance travelled had not been great, yet the delays and disappointments to which one is exposed in a country where means of communication are of the most primitive kind and where, as far as travel is concerned, almost everything is uncertain except the flight of time, made us particularly thankful for so prosperous a journey. Here we were met by friends who had come up from Victoria, or rather from Yale, by the great highway which follows the valley of the Fraser through central British Columbia. They were accompanied by a mule-train laden with stores, etc.; so at Fort St. James we rested for a day to replenish and rearrange our supplies, to write letters to our friends in the east, which would go by way of Victoria and San Francisco, and to prepare for the next stage of our journey, which was to include a ride with a mule-train to Fort McLeod and a voyage by boat through the Rocky Mountains, borne onward by the broad waters of the Peace River.

We left Fort St. James for Fort McLeod on Tuesday, 8th July, accompanied by the pack train which had come up by the Fraser route, and which was to proceed by way of Pine River Pass towards Dunvegan. The only route connecting these two forts is a bridle-path, which leads sometimes over low hills, sometimes by the margin of small lakes, sometimes through thick woods or over treacherous swamps, where we were frequently delayed by the necessity of "brushing" the trail, that is, of laying large branches across the path, so as to afford some footing for our horses and for our pack-mules. About five miles from Fort St. James we passed the trail which leads northward to Omenica, the rival route to that by way of the Skeena, Babine and the Frying Pan Pass for reaching the Omenica gold fields. For about ten miles from Stewart's Lake our trail led through excellent pasture land, the soil being generally rich, with clumps of aspen and spruce; then for about eighteen miles it passed through poor land, covered with fireweed and burnt timber, with occasional groves of black pine.

Our progress was slow, for even on a good trail fifteen miles a day is considered fair travelling, when each mule carries from two hundred to three hundred pounds—and the trail in this case was not uniformly good; yet we found it for the most part pleasant, even although sometimes the woods were so thick that both hands were required to press aside the branches, which would otherwise strike the face. The profusion of wild flowers, the glimpses of stream or lakelet seen through the timber, the broad views caught from some rising ground which the fire had cleared, the procession of riders, moving Indian file, now slowly and carefully over bog and rock or windfall, now breaking into a canter where the trail permitted this freedom, combined to make this part of our journey different from all that had preceded it.

On Thursday, after crossing Salmon River, we reached the height of land between Stewart's Lake and Lake McLeod. Taken by aneroid, the summit is about 2,700 feet above sea level, and 500 feet above Fort St. James. The view, in so far as it is not obscured by burnt timber, is of a gently undulating country, the only visible hills of marked altitude being the Pope's Cradle Mountain, near Fort St. James, and two mountains lying towards the north, near the trail that leads to Omenica. Although the land looks as if in some parts it might be fit for agriculture, yet its elevation above sea-level and its exposure to summer frosts apparently render it unfit for anything but pasturage. An altitude of 2,000 feet may generally be regarded as the maximum limit of the cultivable land in British Columbia; any arable lands above that level, such as those in the immediate vicinity of Fort St. James, being exceptional; and hardier varieties of vegetables and cereals than those now cultivated in the Province would be required before farming could be profitably conducted throughout this northern portion of the Province, except in favourably situated localities. Indeed, the agricultural resources of British Columbia, as well as its richest mineral lands and its most valuable forests, seem to be confined mainly to the southern part of the Province.

Although the highest land between Stewart's Lake and McLeod Lake is found a little north-east of Salmon River, yet this is not the watershed between the two lakes. This is found some miles further on between Carp Lake and Long Lake. Beyond Salmon River the land is sometimes boggy, sometimes dry and lightly timbered, and the trail is frequently heavy. Having crossed Carp Lake on a raft, we found the trail lead close to its banks for over two miles, and then for half a mile through the shallow water of the margin of the lake. Beyond this we passed a number of large hollows or basins that look as if they had been scooped out of the land. They are of different sizes, for the most part circular, and varying in width from 50 to 100 yards from rim to rim; probably they have rather been built up around the ledges than hollowed out of the level, and although the burnt timber in them shows that they have long been dry, yet they have manifestly been exposed to the influence of water, and may perhaps have been produced by the moraine deposits of a far past glacial period of which frequent traces have been found throughout the Province.

Between Carp Lake and Long Lake we passed the divide that separates the waters flowing into the Pacific from those that flow through Peace River into the Arctic Sea. From Long Lake an excellent trout stream, known as Long Lake River, flows into McLeod Lake; its descent is very rapid, and in its course there is a waterfall of great beauty, estimated at 130 feet in height. A little further on is Iroquois Creek, near which there is abundance of pasture, and a few miles further, in the course of which the trail passes over a height about 750 feet above McLeod Lake, we reach Fort McLeod. Having rested near Iroquois Creek on the 13th, we did not reach Fort McLeod until Monday the 14th July, the whole distance from Fort St. James being estimated at 70 miles.

Fort McLeod, although the oldest of the Hudson's Bay Company's posts in British Columbia, is one of the plainest and most unpretending; it is said to have had its days of greatness, when it was surrounded by a palisade, and had other visible signs of importance, but these are gone. It is beautifully situated at the lower end of MacLeod Lake, with abundance of excellent pasture on the plateau around it, and with a garden attached that seems capable of raising anything that can withstand occasional summer frosts. The snow fall here is heavier than at Fort St. James, averaging about five feet; the lake usually freezes about the middle of November, and opens about the middle of May. All the traffic between Peace River and Fraser River passes this way, as the route from the Parsnip (as the southern branch of the Peace is called) up the Pack River, which flows into it from Lake McLeod, through Lake McLeod and Summit Lake, and over the Giscombe Portage to the Fraser, is much shorter than the route by the head waters of the Parsnip and the head waters of the Fraser.

At Fort McLeod our party was divided, according to instructions, some to go down by the Pack River, the Parsnip, and the Peace to Dunvegan, some to go with the mule train across the Parsnip, up the valley of the Misinchinca, and by the Pine River route towards Dunvegan. We were fortunate enough to secure a commodious boat from the Hudson's Bay Company, at Fort McLeod. The boat was taken down the Pack River to its junction with the Parsnip, about 17 miles, then up the Parsnip, about 12 miles, in order to assist in ferrying across the Parsnip the supplies, &c., that were being conveyed by the mule train towards Pine River Pass. When this was completed, the party that were to continue their journey by Pine River, under the direction of Dr. G. M. Dawson, were left on the north bank of the Parsnip. The others pursued their course down the river.

From the summit of the southern bank of the Parsnip which, at the crossing a little above the Misinchinca, is 120 feet high, an extensive view is opened to the north. For many miles the country appears to be flat, elevated, well wooded, while away beyond, to the east and north-east, the horizon is bounded by a range of hills—spurs or foothills of the Rocky Mountains.

The banks of the river for some distance continue 100 feet in height, and are generally bare, showing exposures of sand, clay and gravel, which have been grooved and worn into fantastic shapes; then they gradually drop to a much lower level, and for some distance above the mouth of Pack River they are only a few feet above the water. Sometimes they are covered with luxuriant pasture, sometimes with rich groves of spruce, cottonwood, and occasional birch, while on the higher slopes the aspen poplar takes the place of the cottonwood.

The river maintains pretty evenly a width of 150 yards, and a current of three or four miles an hour. Below the mouth of Pack River, which is not more than 80 feet wide, the islands become numerous and the banks varied, levels of pasture land alternating with rolling country, low wooded hills, steeps of sand and indurated clay, with croppings, here and there, of sandstone and of limestone. Sometimes the river divides so evenly at the upper ends of the islands that it is difficult to distinguish the main channel, while, at the same time, there are many sloughs—or "slews," so called—where part of the river flows by some devious and half-hidden course, that might, where they blend again with the main current, be mistaken for tributary streams. The voyageurs observe changes on the river from year to year, the course of the stream and the appearance of its banks having perceptibly altered. The soil being light and sandy is easily washed down by the current in spring, when the river rises 15 or 20 feet above its lowest summer level; the shores are cut into new curves; bars of sand and gravel are removed from one locality and built up in another; the islands are worn away above and increased by deposits further down, and the slopes and bushes along the banks have, in some places, been stripped by fire of much of their foliage, while in others they have been covered by new growths of bush or tree.

The Nation River joins the Parsnip from the west, about 35 miles below the mouth of the Pack River; it receives the waters of numerous lakes that lie to the south of the Omenica district between Babine and the Parsnip, a region not yet surveyed, hardly even explored, and little known except to the Indians. From the Misinchinca to the Nation traces of lignite have been found, regarding which, Mr. Selwyn, Director of the Geological Survey, who examined this part of the country in 1875, says: "Some of the blocks found along the shores of the Parsnip were of large size and sufficiently pure and compact to be of value as fuel, if found in thick seams." (*Geological Survey Report* for 1875-76, *p.* 71.) Landing nearly opposite the mouth of the Nation River we found the soil good, the land undulating, covered with a rich crop of wild hay and peavine, from which it may reasonably be inferred that many of the flats and slopes along the river, and perhaps also the upper plateaux, would afford excellent and abundant pasturage.

Below the mouth of the Nation the hills at some distance to the east and north-east, appear more peaked and lofty than those that we saw when higher up the the river. We passed by "bars" where gold has been found year after year, although not in very large quantities, probably borne down by the current from the rocks in the neighbourhood of Omenica. We met straggling miners engaged in prospecting, and some fur traders competing with the Hudson's Bay Company; for the rest the country appeared to be untenanted.

Approaching the Forks where the Finlay and Parsnip meet, some 72 miles below Pack River, we caught to the north east, the first glimpse, high up among the hill tops, of the gap between the mountains through which the Peace River cleaves its way; the hills being here more rugged and more densely massed than anything we had seen since we left the Skeena, while occasional snow peaks could be seen glistening among them.

The Finlay drains a great portion of Omenica by one branch, while by another it receives the waters of an unexplored region to the north of Omenica. For full 300 miles before it joins the Parsnip it has twisted and coiled itself by many a rugged mountain range and through many a rocky canyon, receiving as its tributaries streams whose sands glitter with gold. Here its flow its gentle, but 30 miles off we could see bold snow-capped mountains that tell of the character of the country through which it has carved its way. And the Parsnip, ere the two rivers blend, has flowed nearly as far as the Finlay by many a curve from the uplands where its sources lie near the head waters of the Fraser. As they meet their waters broaden into a small smooth lake, and then rush down a rough and stormy current, nearly half a mile in length and some 800 feet in width, known as Finlay Rapids. Beyond this the names Parsnip and Finlay are dropped; the rapid known by the name of the wilder river has blended their waters beyond all recognition. From this onward till it meets, near Fort Chipewyan, the waters that empty Lake Athabasca, 1000 miles from this, the united river is known as the Peace. The Sicanies call it the Tse-ta-i-kah, " the river that goes into the mountain." The Beavers, who live east of the Rocky Mountains, call it the Unchagah, "The Peace," for on its banks was settled, once for all, a feud that had long been waged between them and the Crees.

About a mile below the rapid the river turns suddenly to the eastward; at this bend it is fringed, on both banks, by gentle slopes and irregular benches, beyond which rise the hills, at first not more than 2,000 to 2,500 feet in height, some scarped by ravines, some castellated with regular strata of rock, but for the most part lightly wooded. This is the beginning of the Peace River Pass. Almost immediately below the entrance Mount Selwyn rises to the right 4,570 feet above the river, 6,220 feet above the sea. It is a massive pyramid, flanked by a ridge of rock on either side, its lower slopes formed by detritus washed down from side and summit, partly covered by burnt timber and tinted by frequent patches of grass; its upper slopes, in part moss-covered, in part bare as polished granite, broken and irregular as if shattered by fire and frost; its sides, now shelving, now precipitous, grooved and seamed by torrent and by avalanche; its edge ragged and serrated, till it terminates in a solitary snow-clad peak. Along the northern side the hills are grouped in endless variety of form, the irregular masses looking as if they had been flung there at some terrible convulsion of nature to show into how many shapes mountains can be cast. Nearly opposite Mount Selwyn the Wicked River, a stream clear as crystal and noisy as a cascade, flows in on the left bank through a gorge between the hills. To right and left alternately sweep the broad curves of the main river, while the ridges between which it winds appears to be dovetailed as you look down the pass. The view changes with each bend of the current; here a rugged shoulder, bare and hard as adamant, butting upward for recognition, there a frowning precipice with no trace of vegetation, or a wooded knoll, solid beneath but with a fair green surface, here a wild ravine, there a great shell-shaped valley, while stretching far up are the peaks that form a resting-place for the eagle and the cloud. The day being fine there was a perpetual play of light and shade on river and hill, and so, as we were swept on by the current. cloud, mountain, and river, peak, bluff and wooded bank were woven into countless and ever-changing combinations.

There was little snow to be seen even on the highest peaks, much less than we had expected; indeed in this respect the Rocky Mountains here are less impressive than the Cascade Range, through which we came when ascending the Skeena, and there are glimpses of scenery on the Skeena grander than anything on the Peace. But here the Rocky Mountains are much lower than they are further south, while the peaks are massed and clustered much more closely than on the Skeena. Gradually as we were borne onward, we found the character of the hills changing, instead of being bald, and peaked, and serrated, they are covered with woods to the summit; the valley begins to widen; to the right rises Mount Garnet Wolseley, the last of the range that seems, with sharp edges, to cleave the sky. Though the river preserves its average width of 250 yards, yet the plateaux on either side broaden till the hills are set about two miles apart, from north to south, summit from summit. We recognize that we have pierced, from west to east, the Rocky Mountain Range through a pass about 22 miles in length, borne pleasantly along in a large boat upon the waters of the great Unchagah.

Passing the Clearwater, and some other small tributaries, whose crystal purity is in marked contrast with the turbid grayish color of the Peace, we run with ease and safety the Parle Pas Rapid, so called because it is not heard far up the river, and may be closely approached before it is recognized as a strong rough rapid. Below this we find flats and benches in almost unbroken succession, stretching between the river and the now receding hills, some of them half a mile in width, when less than thirty feet above the water's edge, with rich soil and luxuriant pasture. The banks, where not broken by the current that in places has exposed the sand, clay, or gravel bed, are green with grass, kinni-kinnik, juniper, low red cedar, vetches, and the beautiful silverberry plant. Along both sides of the river there are terraces in tier upon tier, some with as clear-cut edges as if they had been meant for fortresses, others distinctly marked but wooded. Indeed these terraces form, for many miles, a striking and beautiful feature in the landscape, giving it an appearance of cultivation. Those on the right bank are almost uniformly timbered, those on the north bank grassy and smooth, their sides occasionally seamed by old buffalo trails, for though the buffalo has not been seen here for many years, this was once the pasture land for large herds that found here their western limit. The general appearance on either hand, as far as the portage of the Mountain of Rocks at the head of the canyon, and particularly on the north side where there is little timber, and that chiefly copses of aspen, is that of a pastoral country. Some of the flats and lower slopes might furnish arable farms; others, at this season of the year, appear suited for stock-raising, while the low, grassy hills remind one of some of the sheep-farming portions of Scotland.

Were it necessary or expedient to find a course for the Pacific Railway, as far north as the Peace River Pass, a comparatively easy route is offered in this direction. Even at the wildest and most rugged parts of the pass, the mountains are almost invariably fringed by flats or by gentle slopes of varying width. One or two avalanche courses, a few ravines, and occasional projections of rock would form the chief difficulties, which are apparently much less serious than many obstacles that have been overcome on other Canadian railways. At its higher or western extremity the pass is not more than 1,650 feet above the sea level, and the current of the river, which is very equable, is not more than from four to five miles an hour, where it cuts through the mountain range. East of the pass, for fifty miles, till the canyon is reached, the engineering difficulties would probably be not much greater than those presented by an open prairie. But the chief difficulty on this route would be found at the canyon where the river sweeps round the base of a solitary massive hill, known as the Mountain of Rocks or the Portage Mountain, just above Hudson's Hope; yet even here, although the work would be heavy, the difficulties would be by no means insuperable. This route might be of service if a line were constructed through the Omenica district to some northern Pacific terminus, such as Port Simpson. For any line, however, that would cross northern British Columbia, south of the Omenica district, whether by the Nation River, Babine and Skeena, to Port Simpson, or by any more southerly route, the Pine River Pass, which is known to be practicable, would offer a shorter course than that by the Peace River Pass.

The canyon of Peace River, which, at its upper extremity, is about 50 miles east of the Rocky Mountains, is about 25 miles in length; the river is here a wild and broken torrent some 200 feet in width, that, so far as known, has never been navigated except by the Iroquois crew that accompanied Sir George Simpson on his expedition to the Pacific in 1828. The cliffs are in some places broken into terraces, in others they rise sheer and precipitous for over 250 feet. The course of the river is always curved as it dashes alternately to right and left, while from end to end the canyon forms one great curve round the base of the Portage Mountain. Clambering along the face of the cliff in parts where a foothold was possible we found a narrow seam of bituminous coal about 150 feet above the water, cropping out among the sandstone rock. Another seam, about two feet thick where exposed, wasalso found in the neighbourhood, as well as a seam of lignite. It is not improbable, from these indications, that abundance of coal exists in this vicinity.

This canyon is the only obstruction to the navigation of the river for several hundreds of miles. From the head of the canyon to the mouth of Pack River that empties the waters of McLeod Lake, or even further up the Parsnip, the river is navigable for steamers of light draught. The Parle Pas and the Finlay Rapids are the only rapids of any consequence; these could be run with ease and safety, and could be surmounted without much difficulty by warping the boat against the current as is done on heavier and more tortuous rapids on the Fraser. From Hudson's Hope, at the lower end of the canyon (12 miles by the portage trail from the upper end of the canyon), there is no obtruction whatever to steam navigation till the Vermilion Falls are reached, some 500 miles lower down; and some distance below Vermilion a few miles of land communication would be required to avoid the rapids on Slave River at a place called the Five Portages; when this is passed the river is open to larger steamers down to the Arctic Sea. There would thus be but three breaks in the continuous steam navigation from the mouth of Pack River, down the Parsnip, the Peace, the Slave and the Mackenzie Rivers (which, though differing in name, are in reality one watercourse), that is, from northern British Columbia through the Rocky Mountains, by the fertile Peace River district, to the Arctic Sea, a distance in all, by water of not less than 2,500 miles.

We were compelled to leave our boat at the upper end of the canyon. and being unable to procure a boat or canoe at Hudson's Hope, we made a raft on which we floated down the river to Dunvegan, about 110 miles, reaching Dunvegan on the 1st August, a fortnight after leaving Fort McLeod. At Hudson's Hope, the fertile part of the Peace River district may be said to commence, for above the canyon the land suitable for farming is limited. From this point the river winds its course gently and evenly, sometimes widening to a span of half a mile, encircling islands in its flow, but for the most part preserving an average breadth of from 250 to 300 yards. The banks which, from brow to brow, are usually about three-fourths of a mile apart, are now cut by ravines, now scarped into valleys, now bared by landslides, now grass-grown or wooded. Looked at from the plateau, which stretches out on every hand at an altitude of several hundred feet above the river level, the river seems almost as regular and uniform as a canal cut through a vast expanse of prairie. Occasionally, though seldom, low hills obstruct the veiw in one direction or another, but from Hudson's Hope, eastward, along the course of the river, and for many miles on either side, this plateau is an almost unbroken level of excellent soil. Some of it is timbered, more or less heavily; some of it is open prairie covered with pasture.

The Hudson's Bay posts, a few mission stations, and two or three "free-traders" establishments are the only places occupied by white men throughout this vast northern country that we speak of as the Peace River district, and these are uniformly found on the fertile flats near the river's edge. On those flats the soil is usually of the richest character.

The garden at the Hope yields excellent potatoes, onions, beets, and other vegetables, as well as barley and wheat, the seed of this year's crop having been raised from a single grain, which Dumas, the agent, found accidentally among some rice. On a similar flat at Fort St. John, about 40 miles further down the river, barley and wheat, as well as a great variety of vegetables, are successfully cultivated, while a still greater variety, including cucumbers, are grown with even greater success at Dunvegan, 70 miles below Fort St. John, where wheat has been raised as long ago as

1828. It is the same at all the Hudson's Bay posts along the valley. Situated generally near the river level, these stations of the company have each their garden, with, in some cases, a small farm attached, and in these almost every vegetable and cereal commonly cultivated in Canada, can be raised with success. Wheat is grown as far north as Fort Simpson, at the mouth of the Liard, lat.: 64° north, and it is said that potatoes are grown at Fort Good Hope, near the mouth of the Mackenzie. Wheat and barley grown at the Chipewyan Mission, Lake Athabasca, latitude 58°, 42' north, received a medal at the Philadelphia Centennial Exhibition of 1876.

It is not, however, by the character and capacity of the soil on the fertile flats around the Hudson's Bay Company's posts, that the merits of the Peace River district must be tested, as these flats are comparatively few and small. The district proper consists of the extensive plateau which stretches away for many miles on either side of the river, at an altitude at Dunvegan of about 800 feet above the river, an altitude that gradually diminishes to less than a hundred feet 500 miles farther down the river.

Our party spent the month of August in examining portions of this extensive plateau in different directions from Dunvegan. The facilities for railway construction from Lesser Slave Lake westward, and from a suitable crossing of Smoky River northwards in the direction of Pine River Pass, as well as the character of that pass, are indicated in the reports that refer specially to those subjects. From Pine River eastward to Lesser Slave Lake, and from Dunvegan northward about 70 miles to Battle River, and southward to the 55th parallel, the examination was tolerably thorough. Throughout the whole of the district traversed in these explorations, with very few exceptions, the soil was found to be excellent, with rich herbage, luxuriant wild hay and peavine, and in some parts a great abundance of saskatum, or service-berry bushes. Some tracts lying north of Peace River appear peculiarly fertile, while the district known as "La Grande Prairie," lying between Smoky River and Pine River, from 35 to 70 miles south of Dunvegan, is exceptionally good. Even those parts that are swampy, such as a portion of the country between Smoky River and Lesser Slave Lake, might be drained and made fit for cultivation with no great difficulty by the removal of beaver-dams, etc. Endeavouring to ascertain the character of such portions as we could not possibly examine, we were reliably informed that, following the north and west bank of the Peace River, the soil is excellent for a distance of from 25 to 70 miles from the river; that from Hudson's Hope to Fort St John, with few interruptions, it is heavily wooded; that below Fort St. John the open prairie alternates with copse of aspen and other light woods, for 120 miles, to Smoky River; that from Smoky River to old Fort Vermilion, a distance by the river of more than 300 miles, there is more woodland than open prairie, although the soil is good for about 40 miles back from the main river; that below Vermillion, for a belt of from 15 to 40 miles, the soil is fertile, with occasional interruptions, such as the Cariboo Mountains, at least as far as the Salt Springs on Slave River. Following the south and east bank of Peace River, the plateau from Hudson's Hope, though fertile, is, for the most part, thickly wooded as far as Pine River, which flows into the Peace about 4 miles below Fort St. John. Beyond that, as far as Smoky River, there is a broadening expanse of cultivable land, partly wooded and partly open, which, including the "Grande Prairie," is in some parts at least 70 miles in width from north to south. There, bending with the river, the belt of fertile soil continues for an average it is said, of about 40 miles from the river, as far as Fort Vermilion, and for a narrower belt from Vermilion to Lake Athabasca. East and south of this belt, however, the greater portion of the country enclosed between Peace River on the west and north, and Lesser Slave Lake and Athabasca River on the south and east, is said to be broken by hills, lakes, streams and marshes that render it, to a great degree, unfit for farming. This enclosure is one of the best hunting-grounds for beaver known to the Hudson's Bay Co., 8,000 beaver skins having been received last year at the Hudson's Bay post at Lesser Slave Lake, taken almost entirely from this district.

It would be difficult to form any reliable estimate of the area of arable land in this Peace River district without much more careful examination than has yet been made; but it is manifest that the extent of fertile soil is very great, the best of it apparently being that which lies to the south of Peace River, including what is known as "La Grande Prairie."

Through this district there is a great abundance of moose and bear, the moose being here to the Indian almost everything that the buffalo is to the hunter of the plains. The flesh is his chief article of food; the skin, when tanned, is the great material for dress, at least for winter costume, while untanned it is used for a great variety of purposes; among others as the covering for his tent or tepee; and, cut into strips (in which form it is known as shagnappi), it serves in almost every manufacture, and for all kinds of repairs. While such large game continue plentiful it is vain to expect that the Indians will take to a settled life, or will cultivate the soil, as some of the Indians of the plains are being forced to do by the gradual extinction of the buffalo. Even at the Hudson's Bay posts throughout this district, where most of the vegetables and cereals grown in Ontario can be raised with success, the agents and half-breeds are almost entirely dependent on their hunters for food. They could raise cattle and crops very easily; wild hay is plentiful in the vicintity of many of the forts; the return of potatoes is frequently as high as forty to one, twenty-five kegs of potatoes at Dunvegan having yielded one thousand kegs; and yet many of the Hudson's Bay agents depend for their supply of food very largely on the labours of the Indian hunters that are attached to each post. Their neglect of agriculture is due, no doubt, to the policy which the Company have long pursued of keeping the country as a fur-bearing preserve, furs being of more importance to them than farming; and it is due also, in some degree, to the frequency with which the agents are moved from one post to another, which discourages them from making any improvement on the land, or from undertaking work from which they may probably reap no results. One consequence, however, of this dependence on their hunters for supplies is, that when, as has sometimes occurred, several weeks pass in winter without any snow, and there is no chance of tracking the deer, the people at some of the posts may be reduced to the verge of starvation. Two years ago, at Hudson's Hope, the agent and his family were forced, for a time, to subsist on the untanned moose-hide which had served as window-panes, and their chief complaint was that they had not enough of it.

No attempt has yet been made to cultivate any portion of this vast plateau, with the exception of a very limited area in the vicinity of Lesser Slave Lake; the only cultivated parts throughout the whole district being some of the flats not more than 25 or 30 feet above the river. It might, therefore, be premature, in the absence of actual experiment to pronounce even the most fertile portions of this plateau suitable for the growth of grain. Yet there are various considerations that seem to warrant the conclusion that the climatic conditions of the plateau are not less favourable to the culture of wheat than those of the flats near the river level. Wheat thrives and ripens at Hudson's Hope, Fort St. John and Dunvegan, and also at Lesser Slave Lake, which is on the level of the plateau, even although summer frosts occur occasionally in June and sometimes even in July at those localities, while this year there was frost at Dunvegan, as well as on the plateau to the north and south, during the latter part of August. Though no record has been kept of the changes of temperature on the plateau by which they could be compared with those in the valley, yet it usually seems to be as warm on the plateau as it is nearer the river. Frost sometimes occurs in the valley when it is not felt in the plateau. Horses are kept out all winter upon the plateau, even although the thermometer sometimes falls to 50° below zero, being able to paw away the light snow, which averages 1½ feet in depth, beneath which they find abundance of excellent grass. Cattle are usually home-fed from the latter part of November till the middle of March, large quantities of hay being procured from the patches of meadow land found here and there upon the plateau, and, no doubt, the hay crop could be indefinitely increased if seed were only sown in suitable localities. Although the growth in early summer is usually more advanced in the valley than on the plateau, yet, as the moisture lingers longer on the upper level, the growth there seems to progress more steadily when it has once begun, while very little difference has been observed between the upper and lower levels, in regard to the time of the ripening, fading and falling of the leaves.

The ice in the river at Fort Dunvegan, which usually forms about the first week in December, has, during the past five years as shown by the company's journals, left on the average about the 18th of April, that is, several days before the average date of the opening of navigation at Ottawa. The average date for planting potatoes, during the same period, has been the 4th May; the time for digging potatoes being usually about the 23rd September.

There are not sufficient data to institute a fair comparison between the Peace River country and other fertile portions of the North-West. The soil seems as rich and the herbage as luxuriant as in some of the districts that are already known to be admirably adapted to the growth of grain, but the fitness of the climate, however probable, can not yet be said to be definitely assured. Judging at least by the experience of the past summer the climate of Peace River seems to be scarcely as reliable as that of the Edmonton district where no frosts occurred in August, and where an excellent and abundant wheat harvest has this year been reaped. It might be well, even were Governmental action required to secure it, to have steps taken to ascertain beyond doubt the wheat-growing capacity of this large portion of the North-West. Meanwhile it seems reasonable to suppose, even in the absence of positive experimental knowledge, that a very large proportion of this fertile district, most of which is now ready for the plough, may prove to be an excellent wheatgrowing country and may thus prove to be a very valuable portion of what is as yet the undeveloped interior of the Dominion. In addition to its agricultural resources this district appears to possess abundance of coal, excellent specimens having been found, though in narrow seams, on Elk River (a tributary of Smoky River) on Smoky River and on Peace River. There is abundance of good timber, chiefly spruce, within easy access from the river, while the great facilities for steam navigation afforded by the Peace River, and the large size of several of its tributaries furnish favourable means of communication throughout a large portion of the district.

Every traveller through the Peace River district is surprised at the mildness of the climate. Although the winter is severe, yet the summer is, generally, as warm as that usually enjoyed ten degrees further south in Ontario or Quebec, without the discomfort of oppressively warm nights. There is a marked change between the climate on the east and that on the west side of the Rocky Mountains, that on the east being drier and much warmer. This is probably due to the fact that the prevailing westerly winds blowing from the Pacific have, by the time they come so far inland, been relieved of much of their moisture, first by the Cascade Range and then by the Range of the Rocky Mountains, while at the same time the general level of the country here is lower than that of northern British Columbia. Yet though the average summer temperature is high there is a very great difference between the temperature of the day and that of the night. During the first fortnight of August, '79, the average midday temperature at Fort Dunvegan was 77° above zero in the shade, while the average minimum at night was 42° a fair example of the difference ordinarily observed between the summer temperature of day and night, although sometimes the variation is much greater. This depression of temperature, to whatever cause it is to be ascribed, produces a very heavy dew-fall which seems to assist in promoting the growth of plants, and the change after a warm day is almost as refreshing as a breeze from the sea.

It was the writer's expectation to have come from Dunvegan to Edmonton by a line as nearly as possible direct to Southesk on the located route of the Canadian Pacific Railway, as it was expected that a trail would have been opened along this line during the past summer, but, as the opening of this trail was long delayed he came by way of Lesser Slave Lake and the Athabasca Landing to Edmonton. This route is now the ordinary one for the traffic of the Hudson's Bay Company between Edmonton and Peace River. There is a tolerably good cart road from the Hudson's Bay post, near the junction of the Peace and Smoky Rivers, 50 miles below Dunvegan, to Lesser Slave Lake, a distance of 62 miles. From the Fort near the western extremity of the lake large sail boats run with ease and safety down the lake, some 70 miles in length, down Lesser Slave River, a stream about 40 miles in length, emptying the waters of the lake into the Athabasca River—and down the Athabasca for about 45 miles to a point known as the Athabasca Landing, from which there is a waggon road to Edmonton, 96 miles distant.

The country between Smoky River and Lesser Slave Lake, or at least that portion of it through which the road passes is almost uniformly excellent, part being lightly wooded and part open prairie. Around Lesser Slave Lake there are large marshes yielding abundance of excellent hay, and in this neighbourhood, as already stated, wheat has been grown with marked success, although as yet in very small quantity. To the south of the lake the country is hilly, though near the margin of the lake the land is very swampy; to the north there are numerous marshes, lakelets and streams. The small river that forms the outlet of the lake is about 25 yards in width, very tortuous, hemmed in by low banks that are almost uniformily wooded with aspen copse and willow, between which it winds with very gentle current at a depth sufficient for large H. B. C. boats heavily laden. The soil on either side near the river seems excellent sandy loam, and where free of timber abounds in rich grass and peavine. Ere it joins the Athabasca the river widens to a span of 50 yards and passes over a series of gentle rapids, while its banks become more varied in contour though still closely wooded. At the junction of the two rivers the Athabasca is about 200 yards wide with a current of about 2½ miles an hour. It broadens out in its further flow but its current continues much the same for many miles. The land on either side is wooded with poplar interspersed with spruce; the banks rise by gentle slopes to a height varying from 100 to 200 feet; the soil seems good though light, covered occasionally with luxuriant pasture, but for the most part lightly timbered.

The woods were rich with many-tinted foliage; the shores gravelly, grass-grown and sandy by turns. No signs of life were visible except an occasional beaver; and the Indian crew, knowing that there was ample time to meet the carts that were coming from Edmonton to the Landing, allowed the boats to be borne onward by the gentle current, while, coiling themselves under their blankets, they passed hour after hour in sleep.

Athabasca Landing is at an elbow of the Athabasca, where, after flowing for some distance in a southerly direction, the river turns somewhat sharply to the north-east. This southward stretch from the mouth of Lesser Slave Lake to the elbow is taken advantage of by the Hudson's Bay Company for the transport of their stores, furs, &c., as the route down Lesser Slave Lake, the Lesser Slave River and the Athabasca to the Landing is a very direct one, and, in connection with the waggon road that we traversed from Smoky River Depot, and a waggon road from the Landing to Edmonton, affords the most favourable route for the transport of goods from Peace River eastwards. Between the Landing and Lake Athabasca the river passes over two falls, where somewhat heavy portages would be required, and on this account freight to Fort Chipewyan and the northern districts, instead of passing along this portion of the Athabasca, goes by the Methy Portage and the Clearwater route.

Soon after we had reached the Landing the expected train of carts from Edmonton arrived, and after unloading their cargoes returned. The country for some distance south of the Landing is broken into ridges, the soil being at first poor, but after twenty miles are passed it becomes very attractive, rich with luxuriant grass and pea-vine, watered by frequent streams and lakelets, and occasionally dotted with aspen copse. Approaching Edmonton, and particularly from the crossing of Sturgeon River, the soil is exceptionally rich. The road leads for miles by luxuriant hay meadows, and through gently rolling wheat-lands of great fertility. Large fields of wheat had already been cut,—one field not far from Edmonton covering 100 acres,—and the hearts of the settlers were gladdened by an abundant harvest. We came unexpectedly on a little clump of houses overlooking the Saskatchewan, and a little lower down on the river bank we entered the centre of the settlement, Fort Edmonton, the most important Hudson's Bay Company Post in the North-West Territories.

In order to reach the telegraph station at Hay Lakes, it was necessary to drive about 35 miles south of Fort Edmonton. The road lies through a very beautiful and most promising tract of country, where settlers are already reaping excellent crops. Indeed, judging of the Edmonton district by the country traversed in approaching the Fort from the north, and from that between the Fort and Hay Lakes, as well as by that which is seen from the old familiar trail leading eastward along the north bank of the Saskatchewan, this district is one of the very best, if not unquestionably the best of all the wheat-raising portions of our North-West.

The writer came by ordinary trail from Edmonton *viâ* Battleford, Carlton, Touchwood Hills and Ellice to Winnipeg, but has little to add to what has already been presented in the reports of the Canadian Pacific Railway concerning this portion of the country, save only to confirm the oft-repeated statements regarding the great fertility of a very large proportion of the country traversed, and to express the utmost confidence in its possibilities and in its future.

DANIEL M. GORDON.

# APPENDIX No. 7.

## REPORT ON THE CLIMATE AND AGRICULTURAL VALUE, GENERAL GEOLOGICAL FEATURES AND MINERALS OF ECONOMIC IMPORTANCE OF PART OF THE NORTHERN PORTION OF BRITISH COLUMBIA, AND OF THE PEACE RIVER COUNTRY, BY GEORGE M. DAWSON D.S., A.R.S.M. F.G.S., ASSISTANT DIRECTOR GEOLOGICAL SURVEY OF CANADA.*

### (1.) *Climate and Agriculture.*

The climate of the coast of the northern part of British Columbia, while not subject to great extremes of temperature, is excessively humid, with much rain at all seasons of the year and occasional heavy falls of snow in winter. Neither Esquimalt nor New Westminster, which are the only regular meteorological stations maintained near the coast of the Province, give any criterion by which to arrive at a knowledge of the climatic conditions of other districts; for both these places—but especially Esquimalt—are sheltered from the excessive precipitation which occurs where the moisture-bearing winds first strike the high coast line. Observations maintained by myself while engaged in a geological examination of the Queen Charlotte Islands, during the summer of 1878 (published as an Appendix to the Report of Progress of the Geological Survey, 1878–9), fairly represent the climate of that region during a few months. Observations kept up during many years at Sitka, two and a-half degrees north of Port Simpson, and considerably further west, doubtless represent a climate considerably worse than that of the northern part of the coast of British Columbia. It may, however, be useful to extract from these the following facts. The latitude of Sitka is 57° 3′, or about one degree north of Glasgow (Scotland). Temperature observations extend over a period of forty-five years with little interruption. "The mean temperature of spring is 41·2°; for summer, 54·6°; for autumn, 44·9°; for winter, 32·5°, and for the entire year, 43·3, F°. The extremes of temperature for 45 years are 87·8° and –4·0°. However, the mercury has fallen below zero of Farenheit in only four years out of the 45, and has risen about 80° during but seven years of that period. The coldest month is January, the warmest August; June is slightly warmer than September." The mean of the minima for seven years of the above period is 38·6°, and of the maxima for seven years, 48·5°, shewing a remarkably equible climate. The average annual amount of rain, melted snow and hail from 1847 to 1864 (with the exception of the year 1855) was 82·66 inches, or within a fraction of seven feet; and the average annual number of days on which rain, snow or hail fell, or heavy fogs prevailed, was two hundred and forty-five, or two days out of three, while it does not follow that the other days have a clear sky. Tables by Lütke, from observations in 1828 and 1829, show that on an average each year there were 170 days calm, 132 days moderate winds, and 63 days with strong winds.†

The average annual precipitation of moisture at the mouth of the Columbia River, eleven degrees of latitude further south, is stated to be five inches greater than at Sitka, and it is therefore probable *a priori* that in the vicinity of Port Simpson and about the mouth of the Skeena, on that part of the coast of the mainland lying open to the westerly winds between Queen Charlotte and Vancouver Island' and on the west coasts of these islands, that the precipitation is at least equally great, and amounts to between 80 and 90 inches per annum. This amount of precipitation, though small in comparison with that of a few exceptional places on the earth's surface, is greater than that characterizing even the western coasts of the British Islands, with the exception of a few peculiarly situated mountainous localities, where it is exceeded, and little less than the heaviest rainfall on the Norwegian coast (90 inches).

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* Transmitted for publication in advance of the forthcoming detailed Report on the Explorations of 1879, by permission of A. R. C. Selwyn, F.R.S., F.G.S., Director Geological Survey of Canada.

† Alaska Coast Pilot, 1869, and Pacific Coast Pilot, Appendix 1, 1879, p. 30.

Recently published observations for Fort Tongass, though covering a period of but little over two years, must represent the climate of the region in the vicinity of Port Simpson and of the Queen Charlotte Islands pretty closely, as Tongass is situated on the north side of Dixon Entrance, little over fifty miles from Port Simpson in a direct line. The mean temperature is here 46·5°, or considerably warmer than Sitka. "This may be due," Mr. W. H. Dall writes "to the reception in the open throat of Dixon Entrance of the warm waters of the Alaska Current, fresh from the great north Pacific Gulf Stream."Fort Tongass is the locality of greatest known precipitation in Alaska, the rainfall averaging during the years of observation 118·3 inches, on which Mr. Dall remarks, that observations point to the Queen Charlotte Islands, and the region about Dixon Entrance as the most rainy part of the north-west coast. At Tongass about 200 days a year are either rainy or snowy, a proportion agreeing nearly with that observed at Sitka.*

The excessive rainfall, considered in conjunction with the fact that the sky throughout the year is essentially cloudy, preventing rapid evaporation and keeping the dew point near the actual temperature of the air, accounts for the peculiar character of the vegetation, and the fact that ordinary cereals cannot be grown in the districts exposed to these conditions. At Fort Simpson, on the west coast of the Queen Charlotte Islands, and elsewhere, many of the hills are but partially covered with forest, the remainder of the surface being occupied by sphagneous moss several feet in depth, and saturated with water even on steep slopes. The low north-eastern part of the Queen Charlotte Islands is in great measure sheltered from the rain-bearing winds, and constitutes, in fact, the only extensive area of land which appears to be suitable for agriculture on the northern part of the coast. Mr. Duncan, of Metla-Katla, who kept a meteorological register for some time after his first arrival in the country,estimated that there were on an average about seven fine days in a month in that place. The behavior of the winds and barometer in both Vancouver and the Queen Charlotte Islands, appear to indicate that the centres of most storms, travelling from west to east, pass to the northward of the coast of British Columbia. This being so, it is probable that the force of the gales is somewhat greater on the northern part of the coast of the province than on the southern.

I have elsewhere stated that fogs do not seem to occur with such frequency in the vicinity of the Queen Charlotte Islands as in the southern part of the Strait of Georgia. It may be interesting to quote, in this connection, the following statement by the great but unfortunate navigator, La Péroure, bearing on the northern part of the west coast. † He writes: "I first thought these seas more foggy than those which separate Europe and America, but I should have been greatly mistaken to have irrevocably embraced this opinion. The fogs of Nova Scotia, Newfoundland, and Hudson's Bay have an incontestable claim to pre-eminence from their constant density."

The cause of the exceptional mildness of the climate of this region is to be found not alone in the fact of the proximity of the sea, but in the abnormal warmth of the water, due to the Kuro-Siwo or Japanese Current. The average temperature of the surface of the sea, during the summer months, in the vicinity of the Queen Charlotte Islands, as deduced from a number of observations taken by myself in 1878, is 53·8°. Between Victoria and Milbank Sound, by the inner channels, from May 28th to June 9th, the average temperature of the sea surface was 54·1°. In the inner

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*** Pacific Coast Pilot, Appendix 1, *loc. cit.***

**† Quoted by G. Davidson in Alaska Coast Pilot.**

channels between Port Simpson and Milbank Sound, between August 29th and September 12th, 54·5°, and from the last mentioned date to October 18th, about the north end of Vancouver Island, and thence to Victoria by the inner channels, 50·7°. Observations by the United States' Coast Survey, in 1867,* gave a mean temperature for the surface of the sea between Victoria and Port Simpson and outside the Prince of Wales Archipelago, from Fort Simpson to Sitka, in the latter part of July and early in August, of 52·1°. In the narrower inlets of the coast, the temperature of the sea falls, owing to the quantity of cold water mingled with it by the entering rivers. These observations serve to show the existence, off the coast, of a great body of warm water, and the temperatures closely correspond with those found in similar latitudes, and due to the Gulf Stream and North Atlantic surface drift, on the west coast of Britain. The annual average temperature of the sea surface off the west coast of Britain is stated as 49°, while that of the eastern North Atlantic, influenced by the Gulf Stream, varies from 44° to 54°.†

It will be observed that the summer temperature of this body of warm water appears to be somewhat lower than the mean summer temperature of Sitka. Its influence on the climate is not, however, a direct one, but is chiefly exercised in the following way.—The prevailing south-westerly winds, sweeping over the warm surface of the sea are raised to its temperature, and become saturated with moisture, abstracting from it, as they do so, and rendering latent in conformity with well known physical laws, a still greater quantity of heat. When, on reaching the mountainous coast, this moisture is again condensed and discharged, the latent heat becomes again apparent, and greatly raises the temperature of the atmosphere in which the reaction occurs.

According to Dove's tables, the mean annual temperature of a place situated in the latitude of Glasgow, derived from the temperature of the whole northern hemisphere, should be 35°. Owing to the Gulf Stream and south-westerly winds, the actual mean annual temperature of Glasgow is about 50°, or exceeds the normal by 15°. The mean temperature of the greater part of the North American continent in the same latitude is 5° to 12° below Dove's normal temperature, but that of the regions on the west coast of America—which is related to the course of the Japanese Current in a manner similar to that of the west coast of Europe and the Gulf Stream—as represented by the above detailed observations at Sitka, exceeds the general mean by eight degrees. The mean annual temperature of Sitka being, in fact, nearly the same as that of Montreal, ten degrees of latitude further south.

Many of the islands lying off the northern coast of British Columbia, and forming the great archipelago which fringes it, are low; but, though covered with luxurient forest, possess very little soil, and are in many cases composed of almost solid rock. About Metla-Katla and Port Simpson, small patches of ground are cultivated by the Indians as potato gardens, and good crops secured; but the total area of arable land existing on this part of the coast, with the exception of the portion of the Queen Charlotte Islands before referred to, is so inconsiderable as to be scarcely worth mention.

The coast about Port Simpson and the mouth of the Skeena is very imperfectly sheltered from the rain-bearing winds by the Queen Charlotte Islands, while the islands of the coast archipelago, being for the most part of moderate elevation in this region, abstract little moisture. Where these winds first impinge on the monuntainous mainland the heaviest precipitation occurs, in exact correspondence with the height to which the moist air is forced up into the higher regions of the atmosphere, and cooled there by its expansion and loss of heat by radiation. As the mountains attain a considerable elevation at the coast, and the increase in elevation of the peaks towards the axis of the range is comparatively gradual, the heavy rainfall of the coast is not found to be maintained in travelling eastward by the Skeena River. At forty-five or fifty miles above Port Essington, evidence of decreasing moisture is found, and is still more clearly apparent when Kitsalas Canyon, about half way from Port Essington to the Forks of Skeena, is reached. The devil's club and skunk cabbage (*Echinopanax horrida* and *Lysichiton Kamtschatsense*) luxuriant in the lower reaches of the river and indicative of a humid climate, no longer abound.

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* Alaska Coast Pilot, 1869, p. 20.

† "That portion of the Kuro-Siwo having a temperature of 55° F., or more, approaches the coast of North-west America in the vicinity of Vancouver Island. The precipitation is greater, and sudden meteorological disturbences are more common between latitude 48° and 55° N. than on any other part of the coast, so far as we know. But the water near the coast is less than 55° in temperature, and may average not more than 50°."—Pacific Coast Pilot, Appendix 1, p. 21.

At Quatsalix Canyon, ninety-five miles from the coast, the highest summit of the Coast Range having been passed, the vegetation characteristic of the northern interior of British Columbia may be said to set in ; the western scrub pine and aspen (*Pinus contorta and Populus tremuloides*) growing abundantly on the flats and slopes. The change is so gradual, however, and the blending of the coast and interior floras on the Skeena so complete that it is difficult to assign the precise position of the line.

With regard to the snowfall on the Skeena, Mr. H. J. Cambie during his survey here in 1877, gathered that from Port Essington to near the month of the Lakelse (56 miles), it was exceedingly heavy, reaching a depth of ten feet or more. From this place to Kitsalas Canyon it reaches, at least occasionally, a depth of six feet; while about Kitwungah,—sixteen miles below the Forks—it averages three feet. So far as information can be obtained from the Indians it appears to confirm these estimates. The depth on the benches about the Forks is not over one foot, but owing to local circumstances the snowfall is here considerably less than in any neighboring locality, the average for this part of the Skeena Valley being probably a little under two feet.

At about twenty miles below the Forks, the higher benches at the sides of the river and a few hundred feet above its level, extend several miles back from it, and show soil of fair quality, composed of sandy loam with more or less vegetable matter. It is reported that the Skeena valley continues to present the same appearance further up, and it is certainly wide and low for some distance above the Forks while a considerable width of land suited for agriculture is also found in the valley of the Kispyox to the north-westward.

The summer temperature of the region about the Forks or Hazelton is often high, and the rainfall by no means excessive. According to Mr. Hankin, a trader who has resided many years here, snow generally first falls in October, but melts again, the winter snow not coming till about the middle of December. The winter is in general steadily cold, though there is almost always a thaw in February. The thermometer has been known to reach 48° below zero and to remain for days at a time below—30°.

The winter is in fact about the same as that of Stuart Lake, but the spring is said to open much earlier. Grass begins to grow green and some trees to bud out about the first week in April. Some cultivation is carried on. Potatoes are occasionally nipped by frost in the spring and on two occasions have been effected by summer frosts. They are generally harvested in the end of September, but are ripe before that time, and can be obtained large enough for use about the first of July. Indian corn does not ripen, and wheat, Mr. Hankin believes would be an uncertain crop. The season of 1878 was exceptionally long, and two successive crops of oats ripened before the frost ; the second being a 'volunteer crop.' In favorable seasons, squashes, cucumbers and other tender vegetables come to perfection. A few cattle and horses have been wintered here, the former requiring to be fed for five months, the latter have been kept by clearing away the snow to a certain depth in strips to allow them to scrape for grass.

The Skeena usually opens during the last week in April or first week of May. Ice begins to run in the river early in November, but the river does not generally freeze till the end of December. The river being very rapid, the occasion of its freezing is usually the occurance of a thaw. This sets free great quantities of anchor ice, sometimes very suddenly, blocking the river and causing it to freeze over. In 1867 the river closed on the 13th of November, which was exceptionally early. The river is generally highest in July, deriving most of its water from the melting snow on the mountains. It is lowest immediately after the ice goes.

Without entering into details as to the natural vegetation of the region, it may be said that it appears to indicate that the rainfall is nearly the same as about Quesnel, on the Fraser, while the climate is in general much like that of Quebec or Montreal, with the exception of the winter, which, according to the statements above given, though rather shorter, is more severe.

I am induced to think that Mr. Hankin is wrong in supposing that wheat would not succeed well about the Forks, but this must remain a matter for future experiment.

Meteorological observations kept by myself while on the Skeena, from June 7th to 23rd, being taken *en route* from Port Essington to the Forks, are necessarily imperfect, and as we were engaged in travelling during the day it was impossible to ascertain the maximum temperature. The mean minimum temperature read on a good thermometer carefully placed on nine nights; between Port Essington and Kitsalas Canyon is 43·4° F, the actual lowest reading being 39°. The mean of seven nights from the Canyon to the Forks, 43·6°, the actual lowest being 37·5°. The mean of observations taken about 6 a.m. and 6 p.m.; every day, on the first mentioned part of the river is 50·8°; on the upper part part of the river, 52·8°. The mean of morning readings taken below Kitsalas Canyon is 45° of evening reading, 56·4°. These reduced for the hour and time of the year by Dove's table of corrections, derived from observations at Sitka, indicate actual mean temperature of 49·1° and 53·1°, respectively. The mean doubtless lies between these figures, but their discord shows that we have already a considerably greater range and a climate more continental in character than that of Sitka. Morning observations above the Canyon indicate a mean of 46·6°. Evening observations 58·9°, which, corrected in the same way, yield 50·58° and 55·6° as approximations to the true mean temperature.

Of the Watsonquah River, which joins the Skeena from the south-eastward at the Forks, Mr. Cambie reports that the valley throughout its entire length is in part prairie and sustains a magnificent growth of grass, but is subject to frequent summer frosts and unsuited to agriculture.[*] The Sus-kwa valley which joins the Watsonquah, and up which the trail from the Forks toward Babine Lake runs, contains no agricultural land worth mention, but its northern side has been in many places very completely burnt over, and is covered with exceedingly luxurient grass and pea-vine, forming an excellent summer range for cattle or horses.

Babine and Stuart Lakes occupy portions of a single great valley, which is bounded by mountainous country on either side, and communicates northward with the flat country of the Lower Nechacco. The upper end of the lake rarely freezes completely across, but this is due, not to the mildness of the winter, but to the great depth of the water. A similar circumstance has already been reported for François Lake.[†] A terrace at a height of about 200 feet is specially prominent round the lake, and after reaching this height the land frequently runs back several miles as a level or gently undulating plain. In other places it slopes gradually up, reaching an elevation of 500, 600, or 800 feet above the lake at from two to five miles from it. The valley is not even then shut in by high mountains in its central part, but appears to continue at nearly the same, or a lower level in some places for many miles. The woods are generally light, aspen and poplar frequently preponderating over spruce, and considerable tracts with a southern exposure, from which fire has removed the forest, are covered with luxurient grass, pea-vine, epilobium, &c. The portage between Babine and Stuart Lakes is low, across wide spreading benches, and from half to one third of the surface appears fit for cultivation. Considerable areas of low land also border Stuart Lake.

The aggregate area of land below the 3,000 feet contour line, with light slopes or nearly level, and which may be supposed to have some prospective value, is great; but it is impossible to form even an approximately correct estimate of it till the maps are further advanced. That in sight from the lakes must exceed 500 square miles. The soil is generally good, and the only remaining question is in regard to the character of the climate.

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[*] Canadian Pacific Railway Report, 1878, p. 79.

[†] Report of Progress, Geol. Survey of Canada, 1876-77 p. 47.

The northern or lower extremity of Babine Lake being more closely hemmed in by snow-clad mountains, is evidently less favorably situated than the remainder of this lake and Stuart Lake, and vegetation was found to be decidedly behind that of the Sus-kwa Valley. Mr. Sanpere, who is in charge of two Hudson Bay posts, one at the north end, the other at the middle of Babine Lake, states that at the latter he can grow potatoes and many kind of vegetables, and that his predecessor grew barley, which ripened well. An Indian living on the portage between the two lakes cultivates a little patch of land, and, though very poorly attended to, he had a fine looking crop of potatoes and a little field of barley, the latter about three feet high and with the ear just appearing at the date of our visit (July 4th). He also keeps some cattle here, cutting hay for them in swamps around Stuart Lake. At Fort St. James we found potatoes flourishing, but rather late, having been cut down by a frost in June. Barley was doing well, and has been grown as a regular crop for many years. * In the garden were peas, lettuce, beets, carrots, onions, garlic, turnips, cabbages and cauliflowers, doing well enough, but not carefully cultivated. Wheat has been sown this year as an experiment, and had not suffered from frost at the date of our visit (July 7th).

Temperature observations kept while on Babine and Stuart Lakes, June 27th to July 8th, gave a mean minimum temperature of 40·2°. The mean of the early morning and evening observations is 51·5°. The temperature is here subject to greater and more rapid changes than in the Skeena Valley, and on the night of June 29th we experienced a frost, the thermometer registering 26°, near the northern end of Babine Lake, and in the vicinity of the snow-clad mountains already referred to.

In the valley of Babine and Stuart Lakes the summer season seems to be sufficiently long, and the absolute amount of heat great enough to bring all ordinary crops, including wheat, to maturity, but the question remains to what extent the liability to summer frosts may interfere with the cultivation of some plants, more especially wheat. Though this valley may be regarded as a continuation of the country of the Lower Nechacco, its vicinity to mountains appears to render it somewhat inferior to that district in climate, and places it in this regard, in my opinion, nearly in the same position with the country bordering on François Lake. In previous reports † I have described the flat country of the Lower Nechacco basin as constituting the greatest connected region susceptible of cultivation in the Province of British Columbia. Its area has been estimated at 1,000 square miles. It is based on fine white silty deposits of the later portion of the Glacial period, constituting a soil almost uniformly fertile, and is remote from high snow-clad ranges. In the absence of further information, I can merely repeat what was said of this region on a former occasion, viz., that while it is not probable that wheat can be grown over all parts of its area, it can scarcely be doubted that barley may be ripened almost everywhere in it, while wheat would succeed in chosen spots. This region will, doubtless, at some time support a considerable population, but it is to be remarked that the passage of a railway through it would do little at present toward settling it; for in the first instance, the country to the east of the Rocky Mountains, in the Peace River or Saskatchewan Valleys, would offer superior inducements to farmers and stock raisers.

The country lying in the vicinity of the trail between Fort St. James, on Stuart Lake, and Fort McLeod has already been described by Mr. Selwyn and by Mr. Hunter. ‡ The elevation of the watershed which is characterized by wide sandy

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* Report of Progress. Geol. Survey of Canada, 1876-77, p 51.

† Report of Progress Geol. Survey of Canada, 1876-77, p 45. Canadian Pacific Railway Report, 1877, p. 252.

‡ Report of Progress, Geol. Survey of Canada, 1875-76, p. 34. Canadian Pacific Ry. Report, 1878, p. 73.

flats is about 2,816 feet, taking the height of Stuart Lake at 2,200 feet. With the exception of a belt a few miles wide near Stuart Lake, and rising in places about 400 feet above it, this region is scarcely to be considered as of any agricultural value. It lies to the north of the Nechacco basin previously mentioned. Its surface is considerably broken and the soil generally light, sandy or gravelly. It is at present covered for the most part with burnt woods. A considerable area would doubtless be available for pasture land if the forest were completely removed by fire, and there are numerous swamps and meadows along streams yielding good natural hay. A frost was experienced on the night of July 13th, my thermometer going down to 27°, on Iroquois Creek. No frost occurred at Fort McLeod, nine miles off, and between 400 and 500 feet lower.

At Fort McLeod the potatoes had been cut down by frost in June, but had recovered completely and were growing well in July. The soil is, however, rather poor, and the area of cultivable land not extensive.

D. W. Harmon, in his "Voyages and Travels" published at Andover, Mass., in 1820, states that the snow-fall at Fort McLeod is sometimes as much as five feet, and this is confirmed by those now acquainted with the region. At Fort St. James the snow reaches a depth of about three feet. A difference remarkably great for two places so close together.

From Fort McLeod to the Middle Forks of Pine River, seventy-two miles distant, may be treated together as representing the Rocky Mountains, including the foot hills of both slopes and the higher plateau attaching to these on the north-eastward. From July 17th to August 5th, the mean of the observed minima on this part of the route is 39·7°. The mean of the early morning and evening readings of the thermometer, 49·4°. This must be much below the actual mean temperature, for the thermometer had seldom risen much above its minimum when observed at 6 a.m. The heat was sometimes great in the middle of the day, but as we were then always travelling, could not be registered. Three frosts were experienced, on the nights of the 2nd, 3rd and 4th of August, the thermometer reading 30·5°, 28° and 30°5 on these nights. Strong westerly winds, falling calm at sundown, with a clear sky were the conditions causing the frosts. The quantity of arable land in this mountainous zone is quite inconsiderable, being confined, on the route followed, to the actual valley of Pine River for a few miles above the Middle Forks.

The portion of the Peace River country, for which the exploration of last season enables pretty accurate general information to be given, may be considered as extending eastward from the Middle Forks of Pine River. West of this point, as already stated, the areas of fertile land are small, being confined to certain river valleys which penetrate the foot hills of the Rocky Mountains and high plateau attached to them. With this western limit, the region now to be described may be considered as bounded to the north by the 57th parallel, to its intersection eastward with the Peace River. Thence the boundary may be assumed to follow the Peace River southward to the mouth of Heart Brook, near the confluence of the Smoky River. Thence to run south-eastward to the extremity of Lesser Slave Lake, to follow the western border of the hilly region lying to the south of the lake to the Athabaska River; thence to follow the Athabaska westward to the foot hills, and skirting the foot-hills to run north-westward to the first mentioned point on Pine River.*

The tract included within the limits above given has an area of about 31,550 square miles, and by far the larger part of this area may be classed as fertile. Its average elevation may be stated as little over 2,000 feet, and this is maintained with considerable uniformity, for though the general surface slopes slightly from the north and south toward Peace River, the region as a whole may be considered as a plateau through which the great gorge-like valley of the Peace has been excavated. This valley has in general a depth of 600 to 800 feet below that part of the plateau bordering it, with a width of two to three miles from rim to rim. Its tributary streams at first nearly on the plateau level, flow in valleys of continually increasing depth as they approach that of the Peace River. Those from the south-eastern portion of the region rise either in the Rocky Mountains, or near the Athabaska, the tributaries received by the latter stream from the north and north-west being—with the exception of the Batiste—quite inconsiderable in this part of its course.

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*In addition to the area above defined, my explorations and those of my assistant, Mr McConnell, during the past season, included an examination of the upper part of the Athabasca to Athabasca Landing, of the north shore of Lesser Slave Lake and Lesser Slave Lake River, of a route from the east end of Lesser Slave Lake to old Fort Assiniboine and thence to Edmonton, and of the road from Athabasca Landing to Edmonton. Also of the Athabasca from the Landing to the mouth of the Rivière la Bèche, by the valley of the latter to Lac la Bèche and thence to Victoria and Egg Lake. The country examined on these lines is not included in the present report, as being less homogenous in character than the great region above defined, it requires to be treated at greater length and in more detail. It may suffice for the present to state that considerable areas of fertile land are found throughout, but more particularly in the region south of the line of the Athabasca River.

The ridges and hills by which this region is occasionally diversified, appear in all cases to be composed either of the generally soft rocks of the Cretaceous and Tertiary or of arenaceous clays containing erratics and representing the boulder clays of the glacial period. These elevations are generally slight, and with exceedingly light and gradual slopes, the scarped banks of the streams constituting much more important irregularities. These ridges, however, often resemble detached portions of a higher plateau and spread widely enough to occupy in the aggregate a considerable area, of which the soil is not so uniform in character as elsewhere. With these exceptions, the soil of the district may be described as a fine silt, resembling the white silts of the Nechacco basin previously referred to, and not dissimilar from the loess-like material constituting the subsoil of the Red River Valley in Manitoba. This silt, at a short distance below the surface, is greyish or brownish in color, but becomes mixed superficially with a proportion of vegetable matter to a varying depth. It has evidently been deposited by a comparatively tranquil body of water not loaded with ice, probably toward the close of the glacial period, and has either never been laid down on the ridges and undulations above referred to, or has been since removed from them by natural processes of waste. As evidenced by the natural vegetation its fertility is great.

West of the Smoky River, both to the south and north of Peace River, there are extensive areas of prairie country, either perfectly open and covered with a more or less luxuriant growth of grass, or dotted with patches of coppice and trees.

The northern banks of the Peace River Valley are also very generally open and grassed, and parts of the valley of the Smoky and other rivers have a similar character. The total area of prairie land west of the Smoky River, may be about 3,000 square miles. The remainder of the surface is generally occupied by second-growth forest, occasionally dense, but more often open and composed of aspen, birch, and cottonwood, with a greater or less proportion of coniferous trees. Some patches of the original forest, however, remain, particularly in the river valleys, and are composed of much larger trees, chiefly coniferous, among which the black spruce is most abundant. Handsome groves of old and large cottonwoods are also to be found in some of the valleys. Where the soil becomes locally sandy and poor, and more particularly in some of the more elevated parts of the ridges before described, a thick growth of scrub pine and black spruce, in which the individual trees are small, is found; and in swampy regions the tamarac is not wanting, and grows generally intermixed with the black spruce.

East of the Smoky River, and southward toward the Athabaska, the prairie country is quite insignificant in extent, the region being characterized by second-growth woods of the character just described, which, on approaching the Athabaska, are replaced by extensive and well nigh impassible tracts of brulé and wind-fall, in which second growth forest is only beginning to struggle up.

Though the prairies are most immediately available, from an agricultural point of view, the regions now covered with second-growth and forest, where the soil itself is not inferior, will eventually be equally valuable. The largest tract of poor land is that bordering the valley of the Athabaska on the north. This rises to an elevation considerably greater than most of the region to the north and west, and appears during the submergence to which the superficial deposits are due, to have been exposed to stronger currents which have prevented the deposition of the fine silt, causing it to be replaced by a coarser silt which passes in places with actual sand, and alternates with ridges of boulder clay. This region is also often very swampy, and for a width of twenty to twenty-five miles on the trail from Sturgeon Lake to the Athabaska is quite unsuited to agriculture, though still in many places capable of yielding good summer grazing when the forest has been completely removed by fire. To the northward, more particularly to the east of Smoky River, peaty and mossy swamps occupy part of the surface, and these may be regarded as permanently unsuited to agriculture.

There is also a sandy tract, though of small width, along the lower part of the Elk River near its junction with the Smoky. Deducting, as far as possible, all the areas known to be inferior or useless, with about twenty per cent. for the portions of the region under consideration of which less is known, the total area of land, with soil suited to agriculture, may be estimated as at least 23,500 square miles. In the absence of complete maps, such an estimate cannot be otherwise than very rough, but may serve to give some idea of the fact.

Whatever theory be adopted, and may have been advanced, to account for the wide prairies of the western portion of America further to the south, the origin of the prairies of the Peace River is sufficiently obvious. There can be no doubt that they have been produced and are maintained by fires. The country is naturally a wooded one, and where fires have not run for a few years, young trees begin rapidly to spring up. The fires are, of course, ultimately attributable to human agency, and it is probable that before the country was inhabited by the Indians it was everywhere densely forest-clad. That the date of origin of the chief prairie tracts now found is remote, is clearly evidenced by their present appearance, and more particularly by the fact that they are everywhere scored and rutted with old buffalo tracks, while every suitable locality is pitted with the saucer-shaped 'buffalo wallows.' It is reported that a few buffaloes were seen last year near Pine River, but the animal has now become in the Peace River county practically extinct; an event which, according to the Indians, happened at a date not very remote, owing to a winter of exceptional severity, during which the snow "reached to the buffaloes backs."

The luxuriance of the natural vegetation in these prairies is truly wonderful, and indicates, not alone the fertility of the soil, but the occurence of a sufficient rainfall. The service berry, or amalanchier, and the choke-cherry are very abundant in some places, particularly on the so-called Grande Prairie, which constitutes the great berry gathering ground of the Indians.

With regard to the climate of the Peace River country, we are without such accurate information as might be obtained from a careful meteorological record, embracing even a single year, and its character can at present be ascertained merely from notes and observations of a general character and the appearance of the natural vegetation.

It may be stated at once that the ascertained facts leave no doubt on the subject of the sufficient length and warmth of the season, to ripen wheat, oats and barley, with all the ordinary root crops and vegetables, the only point which may admit of question being to what extent the occurence of late and early frosts may interfere with growth. This remark is intended to apply to the whole district previously defined, though it must be remembered, in considering the subject, that the conditions of places situated in the bottom of the trough-like river valley, and 600 to 800 feet below the plateau, may be considerably different from those of its surface.

The summer season of 1879 was an unusual one, characterized by excessively heavy rain fall, with cold raw weather in the early summer months. These conditions did not extend to the west of the Rocky Mountains, but appear to have been felt over the entire area of the plains to the Red River Valley. As a result of this, the crops generally throughout the North-west were later than usual, and the mean temperature of even the latter part of the summer appears to have been rather abnormally low. Notwithstanding this, on my arrival at Dunvegan, on the 16th of August, small patches of wheat and barley in the garden of the fort presented a remarkably fine appearance and were beginning to turn yellow. On my return to the fort on August 31st these were being harvested, their complete ripening having been delayed by overcast and chilly weather which prevailed between these dates. At the first-mentioned date potatoes were quite ripe, with the balls formed on the stalk, and the garden contained also fine cabbages, cauliflowers, beets, carrots, onions, lettuce and turnips. Dwarf beans, cucumbers and squashes were also flourishing, and though these plants are particularly tender, showed no sign of frost. The two last named having been sown in the open ground did not appear likely to perfect their fruit. A few stalks of Indian corn were also growing, though it is improbable that this plant would ripen its seed in this district.

When this garden was again visited, on the last day of August, the beans, cucumbers and squashes had been cut down by a frost, but not completely killed. The potato tops were also slightly nipped.

Rev. M. Tessier, who has been at Dunvegan as a missionary for some years, has always been able to ripen small, black butter-beans, but in some seasons not without difficulty owing to frosts. He has also tried a few grains of oats which he procured accidentally, and obtained a return of astonishing abundance. About the date just referred to the potatoe plants at Smoky River post (The Forks) were badly cut down by frost, the tubers being, however, quite ripe, fine and large.

On the 15th September, Mr. R. McConnell, my assistant, found the potatoes in the garden of the fort at the west end of Lesser Slave Lake, and on the level of the plateau, little affected by frost, with tubers large and ripe. Mr. H. J. Cambie also ascertained that wheat thrives at this place. We found some rude attempt at cultivation also at the 'Cree Settlement,' which consists of a few log houses built by Indians on the border of Sturgeon Lake, about 70 miles south-west of the west end of Lesser Slave Lake, and is at the average level of the country, with an elevation of about 2,100 feet. Here, on September 14th, the potatoe plants were slightly affected by frost, but not more so than observed with those at Dunvegan two weeks before. The tubers were quite ripe, but the Indians did not intend to dig them for about ten days. Turnips were very fine, and carrots, beets and onions were good, though evidently cultivated with very little care. Two or three very small patches of barley had been almost completely destroyed by mice, but a few stalks remaining were quite ripe and with fine heads. The Indians here were very anxious to have a supply of garden seeds, which I have since been able to forward to them by the kindness of Messrs. Stobart, Eden & Co., of Winnipeg.

At Fort St. John, 95 miles west of Dunvegan, and so much nearer the mountains, on July 26th, 1875, Professor Macoun states that potatoes, oats, barley and many varieties of vegetables were in a very flourishing state in 'Nigger Dan's' garden. The oats stood nearly five feet high and the barley had made nearly an equal growth.* The barley and oats were both ripe about the 12th of August. Prof. Macoun was informed by Charlette at Hudson's Hope, thirty miles still further west, that in 1874 there was no frost from the 1st of May until the 15th of September. In 1875 sowing commenced the last week in April. There appears to have been a frost on June 28th, but the first autumn frost occurred on the 8th of September, and Mr. Selwyn found the potato tops still green in the middle of the month. Mr H. J. Cambie saw wheat flourishing here in July last, but on his return in September it had been cut down by frost.

Such are the notes that can be obtained on the growth of cereals and vegetables in the district in question. From information obtained at Dunvegan, it seems that the snow disappears about the middle of April, westerly winds sweeping it away fast. The river opens at about the same time. Cultivation begins at about the end of April or first of May. The river generally begins to freeze in November. The depth of snow, I was told, averages about two feet, an estimate which agrees with Mr. Horetzky's statement.† Mr. Horetzky was also told that the plains were often nearly bare up to the month of December, though the winter usually sets in with the month of

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* Report of Progress, Geol. Survey of Canada, 1875-6, p. 164.

† Canada on the Pacific Coast, p. 205.

November. Sir Alexander Mackenzie remarked the same absence of snow in the early winter months of 1792. It was entirely gone on April 5th, 1793, and gnats and mosquitoes were troublesome on April 20.* Horses almost invariably winter out well without requiring to be fed. Hay should be provided for cattle, to ensure perfect safety, for a period of three or four months, though in some seasons it is necessary to feed the animals for a few weeks only. The Indians of the 'Cree Settlement' on Sturgeon Lake, previously referred to, winter their horses without any difficulty round the borders of a neighboring lake, the shores of which are partly open. From Hudson's Hope, the horses are sent southward to Moberly's Lake to winter, and according to Mr. Selwyn, do well there. Lesser Slave Lake, with its wonderful natural meadows, has long been known as an excellent place for wintering stock, and is referred to as such by Sir J. Richardson.

Some general idea of the length and character of the seasons at Fort St. John may be gained by an examination of the extracts from the journals from 1866 to 1875, published by Mr. Selwyn.† The dates of opening and closing of Peace River, being an important clue to the mean temperature of the region, may be quoted as summarized by Prof. Macoun in the same report (p. 156).

| Ice breaking | | | Ice drifting, first time |
|---|---|---|---|
| 1866 | April | 19 | Nov. 7. |
| 1867 | " | 21 | " 8. |
| 1868 | " | 20 | " 7. |
| 1869 | " | 23 | " 8. |
| 1870 | " | 26 | no record. |
| 1871 | " | 18 | " 10. |
| 1872 | " | 19 | " 8. |
| 1873 | " | 23 | " 4. |
| 1874 | " | 19 | Oct. 31. |
| 1875 | " | 16 | |

The average date of the breaking up of the ice may thus be stated to be April 21st; that on which ice is running on the river for the first time, November 7th. In 1792 and, 93, when wintering at the mouth of Smoky River, Sir Alexander Mackenzie observed the ice to be running for the first time on November 6th, while the river was clear of ice on the 25th April. I have been unable to find any precise records of the dates of closing and opening of the Saskatchewan, but Dr. Hector states these are usually the second week of November and the second week of April respectively. The Saskatchewan is a more rapid stream than the Peace.

With regard to the probable difference between the actual valley of the Peace and the plateau forming the general surface of the country, Prof. Macoun observes,‡ speaking of the vicinity of Fort St. John, that notwithstanding the difference in altitude the berries on the plateau ripened only about a week later than those near the river, while he was informed that there was about the same difference in the time of disappearance of the snow in spring. While at Dunvegan, I ascertained that a similar difference was observed there, but it was added that this obtained chiefly with the wooded parts of the plateau, the snow disappearing on the prairies much about the same time as in the valley. In my diary, under date September 5th, I find the following entry:—"Aspens and berry bushes about the Peace River Valley now looking quite autumnal. On the plateau 800 or 900 feet higher, not nearly so much so. Slight tinge of yellow only on some aspen groves." This difference, through not altogether constant and depending much on diversity of soil, appears to be actual. In October, 1872,

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* Voyages, p. 131-132.

† Report of Progress, Geol. Survey of Canada, 1875-76 p. 84.

*Op. Cit.*, p. 155,

Mr. Horetzky writes: * "We observed that, curiously enough, the vegetation upon these uplands did not appear to have suffered so much from the effects of frost, this being probably due to the fact of the air in these upper regions being constantly in motion, while in the deep and capacious valley of the river the winds have often no effect"

The difference between the valley and the plateau being thus very small, I have not treated separately the observations for temperature taken by myself in the different situations. Most of the observations, however, refer to the plateau, and including the whole time spent in the country, from the Middle Forks of Pine River to the bank of the Athabaska, cover a period of nearly two months. The mean minimum temperature for the month of August, deduced from observations extending from the 6th to the 31st of the month is 39·9°. The mean of observations at 6 a. m. during the same period is 42·3°. That of the observations at 6 p. m. 59·5°. In September the mean minimum temperature was 28·1°. The mean of morning observations 34·3°, of evening observations 51·5°. I have endeavored to deduce from these observations means temperatures for the months in question, by correcting them by the tables of hourly variations in temperature given by C. A. Schott in the Smithsonian Contributions to Knowledge (No. 277), but find it impossible to do so, as the daily range is here so much greater than that of any of the places represented by the tables, which refer chiefly to the eastern portion of the continent. It would appear that while in most places the mean temperature of the day is reached about 8 p. m., it is found in the Peace River country not far from 6 p. m., by reason of the increased rapidity of loss of heat by radiation due to greater elevation and dryer atmosphere. The maximum temperature was seldom observed, but the daily range is very great, and the maximum probably several times reached 80° in August, and often surpassed 70° in September.

From the 6th to the 31st of August I registered two nights of frost, on the 13th and 20th of the month when the thermometer showed 32° and 26° respectively. Both of these were observed on the plateau, but one at least of them (that of the 20th) must have occured also in the valley, from the effects produced Dunvegan on tender vegetation. These frosts occured in very fine weather, following a day of strong westerly wind, the result of which is to remove from the surface of the earth the whole of the lower heated layer of the atmosphere. This. succeeded by a calm and cloudless night with transparent sky, causes the thermometer to sink below the freezing-point before morning. When not preceeded by strong wind, mere transparency of the atmosphere seems seldom or never to lead to frost in August, in this district, as many beautifully starlight nights without an approach of the mercury to be freezing-point were observed.

Though in some cases such frosts as these may be general, and extend over a wide district of country, it is more usually found that they are quite local in character. A few floating clouds, or light wreaths of mist, may arrest radiation so far as to prevent frost over the greater part of the country, while some spot accidentally exposed during the whole night under a clear sky experiences a temperature below 32°. The contour, and character of vegetation of the country also have much to do with the occurrence of frosts, and it is very frequently the case that river valleys are more subject to frosts than the upland districts. During the month of September, in a region for the most part wooded, and often above the average altitude, between Dunvegan and the Athabaska, nineteen frosts were registered, the actually lowest temperature being 20° on September 18th.

Through the kindness of Colonel Jarvis, of the North-west Mounted Police, I have been able to secure a copy of records kept by Dr. Herkomer, of Fort Saskatchewan, on the Saskatchewan River, about twenty miles north-east of Edmonton. For comparison with the observed temperatures in the portion of the Peace River country now discussed, they are invaluable; for in the whole district surrounding Fort Saskatchewan and Edmonton we now know from actual and repeated experiment that

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Canada on the Pacific p. 44.

wheat and all other ordinary cereals and vegetables thrive, and yield most abundant crops. The climate in its great diurnal and annual range corresponds exactly with that of the Peace River country. Fort Saskatchewan is situated on the brow of the Saskatchewan Valley, about seventy feet above the river, and therefore probably less liable to frosts than either the bottom of the river valley or extensive flat tracts of plain where there is little circulation of air. This, with the position of the thermometers in regard to the buildings, leads to the belief that if at all in error, as representing the climate of the region generally, the indicated temperatures are slightly too great. The thermometer appears to have been read in all cases to the nearest degree only.

A comparison may be made between the temperature observed in the Peace River country during August and September, with those at Fort Saskatchewan, as follows.—

| | |
|---|---|
| Peace River Country, mean of minima during August | 39· 9° |
| “ “ “ September | 28· 1° |
| “ Frosts experienced during August | 3 |
| “ “ “ September | 19 |
| For Saskatchewan, mean of minima during August | 39· 3° |
| “ “ “ September | 31· 1° |
| “ Frosts experienced during August | 0 |
| “ “ “ September | 15 |
| Fort Saskatchewan, mean of maxima during August | 77· 8° |
| “ “ “ September | 68· 1° |
| Fort Saskatchewan, deduced mean temperature of August | 58· 6° |
| “ “ “ September | 49· 6° |

The mean of maxima and actual mean temperature for the months cannot be stated for the Peace River country. The actual mean for Fort Saskatchewan is obtained by adding the minima and maxima for each month together, and is probably very nearly correct.

While regretting that the data at disposal for the determination of the agricultural value of the Peace River country are not more ample, we may I believe, arrive with considerable certainty at the general fact that it is great. From such comparison as can be made, it would be premature to allow that the climate of the Peace River is inferior to that of the region about Edmonton or the Saskatchewan. It is true that in both the Saskatchewan and Peace River districts the season is none too long for the cultivation of wheat, but if the crop can be counted on as a sure one,—and experience seems to indicate that it may—the occurrence of early and late frosts may be regarded with comparative indifference. The season is at least equally short throughtout the whole fertile belt from the Peace River to Manitoba, though early and late frosts are not so common in the low valley of the Red River. The almost simultaneous advance of spring along the whole line of this fertile belt, is indicated by the dates of the flowering of the various plants, a point referred to by me in some detail elsewhere.* It is further unquestionable that the winter is less severe, and not subject to the same extremes in the Peace River and Upper Saskatchewan regions as in Manitoba.

We have already found reason to believe that the early and late frosts, and not the absence of a sufficient aggregate amount of heat, constitutes the limiting condition of wheat culture in the North-west; but that neither the Saskatchewan nor the Peace River countries lie upon the actual verge of the profitable cultivation of wheat appears to be proved by the fact that oats succeed on the Saskatchewan, and also —in so far as one or two seasons can be accepted as evidence—on the Peace River; while it is well known that this cereal is less tolerant of summer frost than wheat. This is further proved by the fact that at Fort Vermilion and Athabaska Lake, 180 and 300 miles respectively north-east of Dunvegan, Prof. Macoun found wheat and barley ripening well; but in this instance the fact is complicated by the circumstance of the decreasing altitude of the country, which introduces a new condition. As no knowledge has been gained of this country on the Lower Peace in addition to that collected by Prof. Macoun in 1875,* it is not included in the above discussion, though from it additional great areas might doubtless be added to the fertile tract.

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* Geology and Resources of the 49th Parallel 1875, p. 279.

Referring to the journals kept at Fort St. John, Mr. Selwyn, in the report already several times referred to, comes to the conclusion that the climate of the Peace River compares favorably with that of the Saskatchewan country, or Montreal.

It has often been stated in a general way that the cause of the exceptionally favorable climate of the Saskatchewan and Peace River countries, as compared with those of the eastern portion of the American continent, is to be found in the prevalence of warm westerly winds from the Pacific. Sir Alexander Mackenzie speaks of these westerly winds in winter, writing:—"I had already observed at Athabaska, that this wind never failed to bring us clear mild weather, whereas, when it blew from the opposite quarter, it produced snow. Here it is much more perceptible, for if it blows hard south-west for four hours a thaw is the consequence, and if the wind is at north-east it brings sleet and snow. To this cause it may be attributed that there is so little snow in this part of the world. These warm winds come off the Pacific Ocean, which cannot, in a direct line, be very far from us, the distance being so short that, though they pass over mountains covered with snow, there is not time for them to cool." †

Further south these south-westerly currents are known as 'Chinook winds,' and similar consequences are observed to accompany their occurrence. Sir Alexander Mackenzie, however, in the summer of 1793, found the distance to the Pacific coast from his wintering-place, at the mouth of Smoky River, greater than he appears to have imagined at the time he penned the above quoted remarks, and it is difficult indeed, to understand how currents of air, blowing for at least 350 miles across a country which is for the most part mountainous, should retain enough warmth to temper effectually, the climate of the plains to the east. This difficulty would appear to be particularly great in summer, when the mountains are largely snow-clad and the mean temperature of the Peace and Saskatchewan Valleys, is probably considerably in excess of that of the region intervening between them and the sea.

The complete explanation is to be found in the great quantity of heat rendered latent when moisture is evaporated or air expanded in volume, but which becomes sensible again on condensation of the moisture or compression of the air.

The pressure in the upper regions of the atmosphere being so much less than in the lower, a body of air rising from the sea-level to the summit of the coast mountains must expand, which implying molecular work, results in an absorption of heat and consequent cooling. The amount of this coling has been estimated at about 1° Centigrade for 100 metres of ascent when the air is dry, but becomes reduced to ½ degree when the temperature has fallen to the dew-point of the atmosphere and precipitation of moisture as cloud, rain or snow begins; the heat resulting from this condensation retarding to a certain degree the cooling due to the expansion of the air. When the air descends again on the further side of the mountain range, its condensation leads to an increase of sensible heat equal to 1° C. for each 100 metres. ‡ It is owing to this circumstance that places in the south of Greenland, on the west coast, during the prevalence of south-easterly winds which flow over the high interior of the country, have been found, in winter, to experience for a time a temperature higher than that of North Italy, or the south of France, though the north Atlantic Ocean from which the winds come can have been little above the freezing-point at this season. The wind well known in the Alps as the foehn, is another example of the same phenomenon.

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* Report of Progress of Geol. Survey, Canada, 1875-76.

† Voyages, p. 138.

‡ The figures are Dr. Hann's, quoted by Hoffmeyer in the Danish Geographical Society's Journal, and reproduced in Nature, August, 1877.

The data are wanting for an accurate investigation of the circumstances of our west coast in this regard, but a general idea of the fact may be gained. We may assume that the air at the sea level is practically saturated with moisture, or already at its dew-point, that in crossing the mountainous region the average height to which the air is carried is about 2,000 metres (6,560 feet), and that it descends to a level of about 700 metres (2,296 feet) in the Peace River country. The loss of sensible heat on elevation would, in this case, amount to 10° C. (18° F.), the gain on descent to the level of 700 metres to 13° C. (23·4° F.). The amount of heat lost by the air during its passage across the mountainous region, by radiation and contact with the snowy peaks, cannot be determined. It is of course much greater in winter than in summer, and depends, also on the speed with which the current of air travels. Taking the mean summer temperature of the coast at about 12° C., (54° F.) and allowing several degrees for loss of radiation, it becomes easy to understand how the western prairies may be flooded with air nearly as warm as that of the coast, though it has travelled to them over a region comparatively cold.

Owing to the great width of the mountain barrier, the main result is complicated by local details, regions of considerable precipitation occurring at each important mountain range, with subsidiary drier regions in the lee. The last of these regions of precipitation is that of the Rocky Mountain range, properly so-called. By this a further addition of heat is made to the air, which then flows down as a dry and warm current to the east.

In addition to the favorable climatic conditions indicated by the thermometer, the length of the day in summer in the higher northern latitudes favours the rapid and vigorous growth of vegetation, and takes the place, to a certain extent, of heat in this respect. This has been supposed to be the case from the luxuriant vegetation of some northern region, but Alfonse de Candolle has put the matter beyond doubt by subjecting it to direct experiment. In latitude 56° which may be taken as representing that of much of the Peace River country, sunrise on 21st June, occurs at 3h. 12m., sunset at 8h. 50m.; while six degrees further south, in latitude 50°, which may be assumed to represent Manitoba, sunrise occurs on the same day at 3h. 49m., sunset at 8h. 12m. The duration of sunlight, in the first case, is 17h. 38m.; in the second, 16h. 23m., or one hour and a quarter in excess in the northern locality. This excess of [illegible] decreases to zero at the spring and autumn equinoxes, and the difference is reversed in the winter.

A further circumstance giving to the Peace River country and that on the upper part of the Saskatchewan, other things being equal, a value as farming land acre for acre considerably greater than that of most parts of the North-west, is the immunity of this region from the visits of the devastating locust or grasshopper (*Caloptenus spretus*). I have elsewhere discussed the question of locust invasions, in several papers,* and it has since been taken up by the United States Entomological Commission.† It must suffice to state here, that while long series of years may pass without the occurrence of serious invasions, these must continue always, or at least for a very long time, to constitute a drawback to the whole territory lying south of a line drawn about sixty miles south of Edmonton, and thence nearly following the border of the wooded country eastward and southward to Manitoba.

### (2.) General Geological features, and Minerals of Economic Importance.

The rocks of the coast of the northern part of British Columbia and its adjacent islands, resemble those of the southern part of the coast, in the same line of strike, and the Victoria series of Vancouver Island. The age of these rocks I believe to be not greater than Palaeozoic, though their crystalline and highly altered appearance might, at first sight, suggest a comparison with still older series. They may be described, generally, as consisting of gneisses, diorites, mica and hornblende-schists, with occasional limestones and great masses of granite or diorite of intrusive origin. About Port Simpson and Metla-Katla these rocks are predominantly schistose and dark in colour. Mica-schist, generally rather fine grained and often glossy, very dark and containing some graphite, is the most abundant material.

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* Canadian Naturalist, Vol. VIII., pp. 119, 207, 411.

† First Annual Report, United States Entomological Commission, 1878.

The dip of the beds is generally north-eastward at high angles. The resemblance of some of these schists to the auriferous rocks of Cariboo and Leech River, Vancouver Island, is close, but I cannot learn that gold in paying quantity has been found in connection with them on this part of the coast. Limestone is found in association with them in some places. Copp[illegible] appear to occur pretty frequently in these or the associated gneissic rocks of the [illegible]st Ranges, but though much prospecting has been done no permanent mines have been established. A rather promising cupriferous vein has been discovered by Mr. J. W. McKay on the slope of the hill immediately behind the Hudson Bay Company's buildings at Port Simpson.

In Work Channel the rocks appear to be chiefly schistose, like those of Port Simpson, but massive granites or granitoid gneisses occur on the eastern shore and probably constitute the range of mountains which follow it. At Port Essington, at the mouth of the Skeena, the rock is a grey hornblendic granite, traversed by dykes similar in composition but coarser in texture. For about sixty mile up the Skeena from this point, gneissic and schistose rocks, micaceous or hornblendic, and belonging to the metamorphic series of the Coast Ranges continue to prevail, and are shown often in great bare mountain sides, on which vegetation is prevented by the occurence of snow-slides. There is no doubt that if required, building stone of fair quality could be obtained in many places from the rocks of this series.

Above the point just indicated, the rocks bordering the Skeena change their character, being of much newer appearance, chiefly felspathic in composition, and, in fact, representing with little doubt the Porphyrite group of my reports of 1875 and 1876. The rocks are greenish, purplish or gray, frequently fragmental, forming agglomerates, or passing over into conglomerates. The boulders and gravel of the river-bed at the same time change their character, being now almost entirely composed of these porphyrites while Mr. Cambie informs me that the stones in the Zymoetz are also similar, proving that the porphyritic rocks have here a wide extension. At Ksipkeeagh Rapid, where a short portage is necessary, the rock over which the canoe is dragged is a rather coarse-grained grey granite, probably intrusive. It appears capable of being quarried into blocks of fair size, breaking along planes of jointage which are nearly vertical, and run S. 50° E., N. 50° W., magnetic. The range of high mountains abutting on the river above Ksipkeeagh appear from a distance to be composed of granite, or some similar massive rock. At Kitsalas Canyon the rocks seem to belong to the porphyritic series, but are much confused and fractured. They are hard, greenish, and felspathic, with no apparent bedding.

The Chimdemash River of the map, four miles above Kitsalas, appears to be that known also as Sebastipool Creek, and if so, is the locality from which a specimen of quartz yielding $42.18 of gold, $13.29 of silver to the ton was brought. The vein yielding this ore has, I believe, been explored to a small extent, but never systematically worked.

Between this place and Quatsalix Canyon, rocks of the porphyritic series are probably most abundantly represented among the mountains generally, but become associated with a considerable and increasing proportion of ordinary sedimentary sandstones not showing evidence of volcanic action.

Fossils also occur in altered ash rocks, like those of the Iltasyouco River,* including belemnites, trigonias, and a coral. These rocks are probably of the same age with those of the Iltasyouco, which, though stated in a previous report to be Jurassic, Mr. Whiteaves is now inclined to regard as probably Cretaceous. In this part of the river extensive exposures of granite also occur, the material being without doubt

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*** Report of Progress, Geol. Survey of Canada, 1876-77.**

intrusive. At Quatsalix Canyon the rocks are grey hard sandstone or quartzites, with blackish argillies, often arenaceous, and generally well bedded, and resembling those of the Nechacco series of my report of 1876.

Rocks of the kind last mentioned continue to prevail to the mouth of the Kitseguocla River, where carbonaceous shales were observed to be included in the series for the first time. These are so homogeneous and dark in color that they resemble coals, and on close examination small fragments deserving to be called coal, and probably representing portions of individual stems which have been imbedded in the formation, may be found. The carbonaceous shales are generally more or less lenticular, and the rocks at this place are very much disturbed. Ironstone in nodules, and irregular sheets is abundant in some parts of the formation.

In the rugged mountainous country between the Forks of the Skeena and the lower or north end of Babine Lake, the rocks seen in the vicinity of the trail are probably entirely of Mesozoic age, and resemble those found on the Skeena from Kwatsalix to the Forks. They are generally sandstones of fine or coarse grain, occasionally felspathic or replaced by porphyrite-like and sometimes brecciated rocks. Carbonaceous shales and imbedded fragments of plants were occasionally found, and in one place a few molluscs. The strike is generally nearly true north and south, but subject to great local irregularity. In the bed of the Tzes-a-tza-kwa River, near the point at which the trail from the Forks reaches Babine Lake, fragments resembling coal were found, but contain too much earthy matter to be useful as a fuel. From the appearance of the mountains visible from different points in this region it seems probable that Mesozoic rocks of the kind described are very widely spread in this part of the province, a belief confirmed by a number of small specimens collected by Mr. Horetzky in neighbouring regions, during the expedition of last summer.

Precisely what horizon these rocks represent it is, as present, impossible to tell, or as yet to enter into any details as to their arrangement or thickness. From their relation to the Porphyrite series above referred to, it appears, however, that they must represent, at least in part, the coal-bearing series of the Queen Charlotte Islands and Quatsino Sound, while they may even extend upward to include rocks of the horizon of those of Comox and Nanaimo.

The mere existence of rocks of this age, is not necessarily in itself, to be regarded as establishing a probability of the occurence of coal seams of economic value, but the general dissemination over the district of coaly shales containing impure coal, points to the occurrence of conditions such as those required for the deposition of true coals, and indicates the possibility, if not the probability, of the occurrence of coal beds of economic value in some part of the region. Specimens of some of these coaly materials collected by myself have not yet been subjected to examination, but two collected by Mr. Horetzky, and analysed at his request in the laboratory of the survey, are reported on as follows by Mr. C. Hoffmann.

*Specimen labelled Skeena, Station 37, nine miles above the Forks.*

Colour, black; lustre, for the greater part, bright, but contains occasional dull layers, consisting apparently of carbonaceous shale. It is rather brittle, does not soil the fingers; takes fire in a lamp flame, burning with a bright somewhat smoky flame, and evolving an empyrumatic odour; in the closed tube yields water and tarry matter. Colour of powder, black, with a faint brownish tinge; the sample communicated no coloration to a boiling solution of caustic potash.

By slow and fast coking the following results were obtained :—

| | Slow Coking. | Fast Coking. |
|---|---|---|
| Hygroscopic water | 1·05 | 1·05 |
| Volatile combustible matter | 15·35 | 19·09 |
| Fixed carbon | 42 70 | 38·96 |
| Ash | 40·90 | 40·90 |
| | 100·00 | 100·00 |
| Ratio of volatile combustible matter to fixed carbon | 1—2·78 | 1—2·04 |

By slow coking the under portion of the powder alone was sintered, the middle and upper portions remaining pulverulent. Fast coking gave a firmer coke. Ash, pale cream colour.

*Specimen labelled Skeena, Station 65, twenty miles above the Forks.*

The specimen was made up of alternate dull layers of what appeared to be carbonaceous shale, and a bright black coal. Occasionally these latter exhibited a conchoidal fracture; but generally showed a very distinct columnar structure, at right angles to the plane of bedding. It does not soil the fingers. In the closed tube yields water, but scarcely any tarry matter; evolves however, a faint empyrumatic odour. Colour of the powder, black; communicates no color to a boiling solution of caustic potash.

Analysis by slow and fast coking give the following results:—

| | Slow Coking. | Fast Coking. |
|---|---|---|
| Hygroscopic water | 1·52 | 1·52 |
| Volatile combustible matter | 7·63 | 7·20 |
| Fixed carbon | 45·61 | 46·04 |
| Ash | 45·24 | 45·24 |
| | 100·00 | 100·00 |
| Ratio of volatile combustible matter to fixed carbon | 1—6·39 | 1—5·97 |

Both slow and fast coking gave a pulverulent coke. Color of ash almost white.

In addition to these, I received from Mr. Hankin. when at the Forks of the Skeena, a small specimen of true coal, apparent of excellent quality. This material came from a point in the Watsonquah River, about eighteen miles from the Forks, and it is reported by the Indians to occur in quantity. I was unable to visit the locality, but it lies nearly on the strike of the carbonaceous beds seen near the mouth of the Kitseguecla, on the Skeena, and may therefore occur in a horizon nearly the same. Arrangements were made to procure a larger specimen, but this has not yet arrived.

Mr. Hoffmann has examined a fragment of this coal, on which he reports as follows.—

Very compact, homogeneous, hard and brittle. Does not soil the fingers. Color black, but with a just perceptible brownish tinge. Lustre dull resinous. Fracture conchoidal. Takes fire in a lamp flame, burning with a bright flame (which however soon dies out on removal from the source of heat), with emission of smoke and a slight empyrumatic odour. Heated in a covered crucible it produces a large amount of flame. In the closed tube yields a considerable quantity of tarry product. Its powder did not impart the slightest coloration to a broiling solution of caustic potash.

An analysis by fast coking gave the following results:—

| | |
|---|---|
| Volatile matter | 40·52 |
| Fixed carbon | 57·51 |
| Ash | 1·97 |
| | 100·00 |

A determination of the water gave 0·85 per cent., as however, owing to lack of material, no control was made, the amount of this constituent is included in the number indicating volatile matter. Rapid heating gave a firm coke. The ash, which was somewhat bulky, had a slight reddish brown color and agglutinated slightly at a bright red heat. This is an excellent fuel and closely resembles a coal of the true coal measures.

In the present isolated position of the northern interior of British Columbia, the possible existence of workable deposits of coal is a matter of indifference, but in the event of the opening of any route through it, it would be exceedingly desirable to have all parts of the extensive Mesozoic area subjected to a geological examination as close as possible.

Gold has not been found extensively, or in such quantity, as to give rise to permanent mining on the Skeena or the Nasse.

The hills behind the Hudson Bay post, on the east side of the north or lower end of Babine Lake are of sandstones and fine-grained conglomerates with a strike of N. 15° E. (mag.) and high north-westerly dips. Some beds might form good building material if opened below the frost-shattered surface. For some distance southward on the lake, similar rocks prevail, but from Na-tal-kuz Mountain and the second Hudson Bay post to the head of the lake, rocks which may be referred to the Cache Creek group of the interior of British Columbia, and are probably Carboniferous in age, appear to form the sub-structure of the country; while Tertiary volcanic materials lie upon them, and characterize long stretches of the lake shore. Banded limestones and marbles occur on the north bank, near the great bend of the lake. The rocks of the portage, for some miles from Babine Lake, appear to be Tertiary, while near the head of Stuart Lake massive grey hornblendic granite occurs. In travelling down Stuart Lake, in haste and with bad weather, very little chance occurred for the examination of the rocks. The granite above referred to is soon, however, replaced by a schistose greenish and greyish series, and in the hills north of the Pinchi River, massive limestone beds were first made out. These run south-eastward forming the range along the north-east side of the lake, and culminating in Na-katl, or Pope's Cradle, 4,800 feet in height, a few miles from Fort St. James. These limestones have already been described* and are known to be of Carboniferous age.

Between Fort St James, on Stuart Lake, and Fort McLeod, the surface is almost everywhere covered with drift deposits, and consequently, though travelling nearly at right angles to the general strike of the rocks of this part of the province, little can be ascertained as to their character. Neither the Tertiary basin, previously outlined on the Lower Nechacco River, nor that of the vicinity of Fort George, appears to extend as far north as the line of route just referred to. There appear, however, to be outlying patches of Tertiary volcanic rocks, which rest upon the older formations. These, as indicated chiefly by the debris and drift of the surface, and stones found in brooks, seem to include rocks both of the Cache Creek and Mesozoic series. On Long Lake River, near Iroquois Creek, rocks with little doubt belonging to the first mentioned series occur and include felspathic materials and bands of limestone. In the vicinity of Fort McLeod, rocks similar to these, but with thicker beds of limestone, are found. North of Fort McLeod, on the Parsnip, Mr. Selwyn believes an area of Tertiary lignite-bearing rocks to extend as far as the mouth of the Nation River. Lignite was observed in places near the junction of the Pack, or McLeod's Lake River, with the Parsnip, and loose blocks of a quality likely to be serviceable as fuel, were found scattered further down.†

In continuing eastward from the Parsnip River by the Misinchinca, the country, to Azouzetta Lake at the summit of the Pine River Pass, is characterized by schistose and slaty rocks, with occasional bands of quartzite. The schists are generally micaceous and often very bright, with lustrous surfaces which are not unfrequently minutely wrinkled. These together form a well marked series, and as they occupy a belt of country about twenty miles in width, and are generally at high angles, are doubtless many times repeated by folding. These rocks appear to overlie the massive limestones of the central range of the Rocky Mountains, which appear to be of Carboniferous or Devonian age. From their lithological identity there can be little doubt that they represent the auriferous series of Cariboo, but they have not here been extensively prospected, and no paying deposits of gold have been found in this part of the country.

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* Report of Progress, Geol. Survey of Canada, 1876-77, page 55.

† Report of Progress, Geol. Survey of Canada, 1875-76, p. 71.

On the upper part of the Misinchinca, numerous 'colors' may be obtained on the bars of the river, and while it is possible that rich auriferous deposits may yet be found here, it should be mentioned that the rocks are not so extensively traversed by quartz veins as in the Cariboo region.

It is apparently on the north-western extension of this belt of schistose rocks, that the Omineca gold district is situated. The known auriferous localities here lie about fifty miles north of a line passing westward from the Pine Pass by Forts McLeod and St. James. There are three routes by which Omenica may be reached. First from the coast by the Skeena River, Babine Portage and Firepan Pass. This route is travelled by canoe and on foot. Second by trail from Fort St. James, practicable for pack animals; and third by canoe or boat from the eastward by the Peace and Finlay Rivers. Without entering into details, a glance at the map will show how completely isolated this district is, and account for the scarcity and high price of provisions, which has prevented the working of any but good paying claims and hindered the thorough examination of the country.

Some facts in connection with this district have been given by me in a previous report,* but it has never been visited by any member of the Geological Survey. The main points which seem to bear on the possible future of the district are as follows:—The existence of rich deposits of gold, and the possibility that with greater facility of access the known area covered by these would be increased, and that it would become possible to work those of a lower grade. The occurrence of pellets of native silver or amalgam in association with the gold. It may not be found possible to trace this material to veins of workable dimensions, but its presence seems in some degree to show the general argentiferous character of the district. The chief promise of future importance as a mining centre seems to lie, however, in the fact that highly argentiferous galena occurs in some abundance, and, it is reported, in well-defined and wide veins. These it is at present impossible to utilize, owing to the cost of labor and carriage, but the subjoined particulars may serve to give some idea of the character of the deposits.

According to Mr. Woodcock, of Victoria, some of the most important veins are in the vicinity of a stream called Boulder Creek.

That known as the "Arctic Circle" is said to be about twenty feet wide, and to show about four feet of highly metalliferous ore. It is exposed by the brook in a face about thirty feet high. The claim adjoining this is called the "Black Warrior," and shows a vein eight feet wide of nearly pure galena. Other specimens have been obtained from places within a radius of eight miles from this locality.

Near Lost Creek a vein known as the "Champion Ledge" is found, and runs nearly parallel with the stream. Particulars as to its size are wanting. Another vein in the creek is reported to be twenty feet wide.

Mr. Woodcock has favored me with copies of the following analyses of two specimens of the ores from this district, by Messrs. Johnston, Matthy & Co., London, England.

*Arctic Circle Vein.*

| | |
|---|---|
| Lead | 26·80 |
| Iron | 2·50 |
| Silver | 0·13 |
| Sulphur | 6 35 |
| Silica | 61·60 |
| Alumina | 1·40 |
| Combined water | 0·95 |
| Oxygen and loss | 0·27 |

Silver equal to 44·2 oz. per ton of 20 cwt.

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* Report of Progress, Geol. Survey of Canada, 1876-77, p. 116.

A second analysis of the Arctic Circle ore, is by G. W. Hopkins, San Francisco, and gives the following result :—

Silver, per ton, 40·81 oz. or $52.76.

Gold, trace.

Pig lead would contain about 50 oz. to the ton.

### *Black Warrior Vein.*

| | |
|---|---|
| Lead | 20·25 |
| Iron | 2·15 |
| Silver | 0 09 |
| Sulphur | 4·80 |
| Silica | 69·80 |
| Alumina | 1·50 |
| Combined water | 1·00 |
| Oxygen and loss | 1·41 |
| | 100·00 |

Silver equal to 29·8 oz. per ton of 20 cwt.

A second assay of the "Black Warrior," by Messrs. Riehn, Hemme & Co., San Francisco, showed the sample to contain 98 oz. or $126.70 of silver to the ton, equal to $187.10 per ton of pig lead.

Two assays of specimens of ore from a deposit known as the "Mammoth Ledge," gave the following results. Assay by Thos. Price, San Francisco :—

| | |
|---|---|
| Gold, per ton, $\frac{1}{10}$ oz. | $ 2.06 |
| Silver do $32\frac{4}{10}$ oz. | 41.89 |
| | $43.95 |

Clean galena would assay, $131.85.

Assay by Messrs. Riehn, Hemme & Co., San Francisco :—

| | |
|---|---|
| Gold, per ton | $ 6·28 |
| Silver do | 91 13 |
| | $97·41 |

Pig lead would contain 207 ounces to the ton.

A specimen of quartz with galena, from a stream near Mansen Creek in the same district, was examined by Mr. Hoffmann some years ago * and found to contain 8·971 oz. of silver to the ton, with traces of gold, but, as Mr. Hoffmann remarks, the silver is confined to the galena, of which only a small quantity occurs in the vein-stone, and which must consequently be highly argentiferous. An analysis of a sample of galena from the Arctic Circle vein, separated as far as possible from the gangue, in the laboratory of the Survey, gave 128 oz. of silver to the ton. A specimen of ore from the Champion Ledge, including galena and gangue, showed 20 oz. of silver to the ton and a trace of gold.

It would thus appear that a considerable percentage of silver occurs in all the galena ores examined from this district, and that if the veins are sufficiently large and constant in character, the region must be of importance when sufficient means of access to it are provided.

All these ores might, by ordinary process of dressing and washing, be raised nearly to the grade which they show when the precious metals are calculated to the proportion of galena contained.

During the summer of 1879, there were, as I have been informed, about sixty white men engaged in mining at Omineca, with twenty Chinamen, and sixty to seventy Indians, the latter receiving wages as laborers of $3 a day. I am inclined to believe, however, that these figures may be rather above the mark than below it.

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* Report of Progress, 1875-76, p. 430, 1876-77, p. 116.

To the north-east of the schistose rocks, and apparently underlying them, are the massive limestones which form the axial mountains of the Rocky Mountain range. These, in their direction of strike, are parallel to the general north-westerly and south-easterly trend of the range. From the line of the summit, or Azouzetta Lake Valley, the width of the limestones and other old rocks measured transversely is about five or six miles only. On the north-eastward side of the range, the limestones become associated with quartzites which may be of greater age, and with blackish shales and slaty rocks holding *Monotis subcircularis*, and therefore to be assigned to the Triassic period. These rocks of the axis of the mountains are not known to be of any economic importance, though in some places capable of yielding building stone of fair quality. 'Colors' of gold may be obtained in the upper part of the Pine River, as on the Misinchinca.

From the point on the upper Pine River last described, rocks probably for the most part of Cretaceous age, but possibly passing up into Tertiary in some places, extend over the whole upper part of the basin of the Peace River. A line drawn from this point north-north-westward to near the confluence of the Otter Tail River with the Peace—a distance of about forty-five miles—probably marks with approximate accuracy, for a portion of its length, the junction of these newer rocks with the main mass of the older rocks of the axis of the mountains. There is evidence that this line is nearly that of the shore at the time of the deposit of the Cretaceous rocks, and that the present axial elevations of the Rocky Mountains have stood as an island or islands above the Cretaceous sea. Cherty fragments, like those associated with the limestones of the mountains, are found abundantly in the conglomerates and sandstones of the newer series. The existence of the remains of plants, and of seams, of coal in different parts of the newer rocks, show that the sea must have been a shallow one, and by occasional elevations, patches at least of its bed were, from time to time, converted into land areas.

It is in these rocks, forming a zone to the east of the Rocky Mountains, that the most promising coal-fields of the North-west lie, and they are now known to be characterized by the presence of coal from the Peace River to the 49th parallel. Their study is consequently attended with interest, and much additional light has been thrown upon it by the examination of sections in the Peace River region, last summer. Till maps are complete, and the whole of the observations properly discussed, it would be unwise to attempt to enter into detail, but some points bearing on the carboniferous character of the formation may be given.

In the vicinity of the mountains, the rocks are much flexed, but the undulations gradually lessen as the mountains are left behind, and the beds become at length horizontal, or so nearly so that no inclination of a fixed character can be detected by ordinary methods. Near the mountains the rocks are almost entirely sandstones, and often quite coarse and associated with conglomerates. Further off, shaly intercalations appear, and eventually two well marked and thick zones of dark colored shales are found, separated by a zone of sandstone and shales, and capped above by a second sandstone and shale formation, which may possibly belong to the lower part of the Tertiary.

In both the horizons characterized by sandstones coal is found, and while as above stated the upper may represent a portion of the Tertiary, the lower is certainly well down in the Cretaceous formation. This in itself is a point of considerable importance, showing that the carboniferous character of the rocks is not confined to a single series of beds, but recurs at two stages. It also, probably confirms the view advanced by Dr. Hector and supported by Mr. Selwyn, for the Saskatchewan country, as to the existence of a coal-bearing horizon in the Cretaceous of that region in addition to that of the Tertiary or Laramie age.

The localities in which coal is known to occur in the lower or certainly Cretaceous zone are:—Table Mountain, Coal Brook and vicinity, Portage Mountain and the lower part of Smoky River.

Table Mountain is situated on the south bank of Pine River between the Lower and Middle Forks. It was examined by Mr. Selwyn in 1875, who describes the coal as occurring in four seams, in descending order, six inches, eight inches, two feet and six inches thick respectively.

The coal is stated to be of good quality, but has not been analyzed.

Coal Brook joins the south branch of Pine River a few miles from the Lower Forks, and though a comparatively small stream, has formed numerous fine sections in the soft Cretaceous rocks. Coal was discovered here by Mr. J. Hunter in 1877, and is mentioned by him in the Canadian Pacific Railway Report for 1878 (p. 79). Mr. Hunter favored me with specimens collected by him at this time, and I have since personally examined the locality. The rocks are probably nearly on the same horizon as those of Table Mountain. The coal is of good quality and occurs in several beds, which are however, so far as observed, all very thin, the thickest measuring about six inches. Coal also occurs on the south branch of Pine River above the mouth of Coal Creek, and there is much ground to hope for the ultimate discovery of coal seams of workable thickness in this region.

Portage Mountain is cut through by the canyon of the Peace River above Hudson's Hope. The thickest seam observed by Mr. Selwyn in this place, was again but six inches,* but in July last Mr. H. J. Cambie noticed one about two feet in thickness.

The following analysis of a specimen of coal from this place is published by Dr. Harrington.†

| | Slow coking. | Fast coking. |
|---|---|---|
| Water | 2·10 | 2.10 |
| Volatile combustible matter | 21·54 | 25.09 |
| Fixed carbon | 71·63 | 68·08 |
| Ash | 4·73 | 4·73 |
| | 100·00 | 100·00 |

Ratio of volatile to fixed combustible by slow coking 1–3·32, by fast coking 1–2·71. By rapid heating the coal yielded a fine coke, and it may be regarded in all respects as a fuel of excellent quality, only requiring to be found in sufficient quantity to claim importance.

The coal referred to as occurring on this horizon on the lower Smoky River is in itself of no importance whatever, being but 2½ inches thick. With the fact of the abundance of impressions of roots and branches in the sandstone is shows merely the carboniferous character of the formation to this point. It appears at the very summit of the series of sandstones forming the lower group, at their junction with the overlying bluish shales.

On Rivière Brulé, near its mouth, about fourteen miles from Dunvegan, my assistant, Mr. McConnell, examined a reported coal seam, which proved to be a lignite coal of inferior quality, and about twelve inches only in thickness. Coal or lignite is also reported to occur on Rat River ten or fifteen miles above Dunvegan, but the locality was not visited. It is probable that in both these places it is the lower or distinctively Cretaceous series of sandstone and slates which hold the coal.

Of localities showing coal or lignite in the upper series of sandstones and slates, which may, so far as present information goes, represent the uppermost part of the Cretaceous, or the overlying Laramie group; the first discovered is Mountain Creek, joining Elk River, about fifty-eight miles in a direction nearly due south from Dunvegan. The beds found here were again quite thin, but the bars in the stream are strewn with large blocks which appear to be of bituminous coal rather than lignite, and are of good quality as a fuel. These must be derived from thicker beds than those examined, but which may be below the water-level.

The banks of the Elk River, above the mouth of Mountain Creek, show similar fragments of coal more or less rounded, and on the Smoky River, below the mouth of the Elk, near the base of the upper sandstone series, a seam of good coal five inches in thickness was seen. Drift coal found on the upper part of the main Smoky probably also belongs to this upper sandstone series.

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*Report of Progress, Geol. Survey of Canada, 1875-76, p. 63.

†Report of Progress, Geol. Survey of Canada, 1876-77, table facing p 470.

Sandstones and shales, which might represent either the upper or lower series above referred to, occur on the Athabasca River, and were observed in many places above Old Fort Assineboine to hold coal seams. Two of these were noticed to be of remarkable persistency, and though generally thin, the upper seam was found in one place to measure ten feet in thickness, including however a few shaly partings which would reduce the thickness of good coal or lignite to nine feet two inches. This is separated by about twenty feet of soft sandstone from the lower seam, which is compact and of good appearance and about three feet in thickness.

On a stream entering Lesser Slave Lake from the north, near its eastern end, Mr. McConnell observed numerous fragments of lignite of good quality, but all considerably rounded, showing that they had been brought from some distance.

It would thus appear that while in the region lying between the Athabasca and the Peace rivers, no coal seams sufficiently thick to be of great economic value have yet been discovered, that coal and lignite of good quality occur in two distinct series of beds. Wherever natural sections of these occur in the valleys of rivers and streams, coal in greater or less quantity is found, and the persistently carboniferous character of the beds thus abundantly proven. There can be little doubt that beds of a workable character occur in different parts of this region and will be found by further search.

On the extension of these formations to the south-eastward, a bed of coal, reported to be eight feet in thickness, occurs near the projected railway crossing of the North Pembina River, while between Fort Edmonton and the mouth of the Brazeau River, on the Saskatchewan, a seam of coal fifteen to twenty feet in thickness was discovered by Mr. Selwyn in 1873;* other thick seams are reported on the upper part of the Brazeau.

An analysis of the fuel from the North Pembina River made in 1874 by Prof. Haanel, gives the following composition:—

| | |
|---|---|
| Water | 11·88 |
| Volatile combustible matter | 28·66 |
| Fixed carbon | 57·25 |
| Ash | 2·21 |
| | 100·00 |

The coal collected by Mr. Selwyn at the place above referred to on the Saskatchewan yielded to Dr. Harrington the following result on analysis by slow coking:—

| | |
|---|---|
| Water | 10·09 |
| Volatile combustible matter | 28·69 |
| Fixed carbon | 54·96 |
| Ash | 5·45 |
| | 100·00 |

While neither of these can be classed as true bituminous coals, they are fuels of great value, and compare closely with those brown coals used extensively on the line of the Union Pacific Railway in the Rocky Mountain region.

In many localities on the Peace River, and between that stream and the Athabasca, clay ironstone in nodules and nodular sheets is abundant; but generally not in such quantity as to justify a belief in its economic importance. On the lower part of Smoky River, however, great quantities of ironstone apparently of excellent quality might be collected from the bars and beaches, while in few places in the banks, zones largely composed of ironstone and of considerable thickness occur.

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* Report of Progress, Geol. Survey of Canada, 1873-74, p. 49.

As already stated, gold in small quantity may be found in both the Misinchinca and upper part of Pine River, while as stated by Mr. Selwyn it has been found from time to time, in various places and in paying quantities both along the Parsnip and the Peace Rivers. Mr. Selwyn remarks that there are no gold-bearing rocks on the Peace below Finlay Branch, and suggests that the fine gold of the lower part of the river may have been originally derived from rocks on the western slope of the mountains, or may have been carried from the belt of Laurentian and other crystalline rocks forming the north-eastern boundary of the interior basin, and stretching from Lake Superior to the Arctic Ocean. For the gold of the Parsnip and upper part of the Peace, the former appears to me to be the most probable explanation, while to that found in the Misinchinca, the Pine and other streams in the vicinity of the mountains a local origin must also be granted.

In all this region, below a certain contour line and to the east of it, drift from the Laurentian axis, above referred to is, in great abundance. The height of this contour line may for the present be roughly stated at 2,000 feet. It is in this tract to the east, characterized by Laurentian *débris* that the paying gold-washings of the Saskatchewan are situated, while in the direction of the mountains the 'pay' appears to run out where the Laurentian drift ceases. Gold has also been found in paying quantities in the parts of the Athabasca and McLeod Rivers which traverse this drift-covered region, and the evidence seems to be strongly indicative in all these cases of an eastern or north-eastern source for the precious metal. It would thus appear, that with the exception of the regions of the Parsnip and Upper Peace, the Rocky Mountain zone in this part of its length has not so far been proved to yield gold in paying quantity, but that remunerative placer deposits supplied from the opposite direction, occur at a greater or less distance from the mountains on several rivers.

GEORGE M. DAWSON.

R. Brown, 1864
Mohun, 1874
TODD,
J. HUNTER 1879

# APPENDIX No. 8.

## REPORT ON THE AGRICULTURAL CAPABILITIES OF VANCOUVER ISLAND, BY MR. JOSEPH HUNTER.

NEW WESTMINSTER, B.C., December, 1879.

SIR,—I beg to submit the following report on the agricultural capabilities of Vancouver Island in compliance with your instructions of 23rd June last.

Vancouver Island, lies between N. latitude 48° 20' and 50° 55', and W. longitude 123° 10' and 128° 20'. Its extreme length may be taken at 280 statute miles, and its average breadth at 50 miles; its area is, therefore, about 8,960,000 acres. Its extreme breadth opposite Nootka Sound is 80 miles.

The shore line, more particularly along the west coast, is broken by numerous arms or inlets of the sea, some of them running far into the interior of the Island, which can be crossed at several points in a distance of land travel less than one-third its breadth.

The interior of the Island within certain limits, which will be presently defined, is rough and mountainous.

Quatsino Sound, and a line drawn from its eastern extremity to Fort Rupert, would form the northern limit of the highest interior mountain ranges, while their southern limit may be defined by a line joining Cowichan Harbour with Port San Juan.

The surface of the Island, beyond the limits above described, although occasionally interrupted by mountains of considerable altitude, is of a low, rolling or lumpy character. Between the foot of the mountain slopes and the southern and eastern coast lines, stretches a margin of comparatively flat land, varying from two to ten miles in breadth, while the rivers are bordered, in some instances, for considerable distances farther inland, by narrow flats.

Sheltered by the mountains of the interior, and protected by them from excessive rainfall, the portion of the Island last referred to, contains, as will afterwards appear, most of the agricultural land known to exist, or susceptible of profitable settlement.

Reliable information respecting the interior of the Island, considering that the more accessible portions have been settling up since 1858, is astonishingly meagre.

In the year 1864 an expedition was organized by the Government and people, under the command of Dr. Robert Brown, for the purpose of exploring the interior of Vancouver Island. This expedition, composed in all of 60 persons, and divided into different parties as circumstances dictated, explored during the season the following routes:

1. Across the Island from the mouth of the Cowichan River to Nitinat.
2. From the east end of Cowichan Lake to Port San Juan
3. From Sooke Harbor to Cowichan Harbor.
4. Across the Island from Comox, by Alberni, to Barclay Sound.
5. Across the Island from Nanaimo to Barclay Sound.
6. Across the Island from Alberni to Qualicum.

BARKLEY.

On the first of these routes, embracing 75 miles of land travel, it is reported, in reference to the lower Cowichan River, that, "the surrounding country is in most places flat, with here and there open tracts. The whole of the spar lands are excellent, and it would pay abundantly to clear them for the value of the timber alone."

With reference to the land in the interior, it is stated that "patches of good land are found here and there. On the border of Foley Creek there is much good land thinly covered with maple."

On the second route, extending over 40 miles, it is stated that "the country travelled over is totally unfit for agricultural settlement," and generally mountain pine and cedar everywhere, barren of grass and soil; a home for the deer and herds of noble elk, but fit for nothing else."

On the third route, 30 miles in length, after leaving the vicinity of the mouth of Sooke River, where the country is said to be level and the soil good, "the country lying to the westward consists of conical hills covered with pine; very little level land. To the eastward it is very rugged, consisting of rocky eminences very thinly timbered." The only mention of agricultural land on this route is in respect to the valley of a small stream falling into Sooke Lake, which "seems to contain good soil."

On the fourth route, 70 miles, without specifying particular localities, this general statement is made: "We passed over much timber land fit to be brought into cultivation."

On the fifth route, 60 miles, Mr. Leech writes in reference to the country near the east coast: "To the eastward, between the Nanaimo and Chemaimis Rivers, there is an extensive plain." "I have no doubt but there is good agricultural land in this place." After crossing three distinct ranges of mountains, on approaching the west coast, he says: "We also crossed the Nitinat River, which here flows through an open valley heavily timbered, "and two other good sized streams flowing through very fine valleys, in which I believe there are considerable patches of good land." In reference to the Sarita River, falling into Barclay Sound, it is said that on a lake at its source "a delta of 1,000 acres is formed; it could be very easily cleared and made available for agriculture, as would also the valley through which the Sarita River flows." Barkley

On the sixth route, 20 miles, it is stated: "The first portion of our route for six miles was through a very open, thinly wooded fern country, well adapted for grazing." Beyond this, no mention is made of any agricultural lands on the route, between the head Alberni Canal and the mouth of the Qualicum River on the Strait of Georgia.

Mr. Leech passed accross the Island from the head Muchalat Arm, on the west coast to the mouth of Salmon River, on Johnson Strait, 65 miles, and, with the exception of "a wide valley heavily timbered, first-rate soil," on Cameron Creek, near the summit, recorded the existence of no agricultural land in the interior.

Mr. Mohun, an engineer acting under the instructions of the Government of British Columbia in 1874, to explore that part of the Island from Fort Rupert southward to Menzies Bay, near Seymour Narrows, a distance of 125 miles, penetrated at various points into the interior. He reports 6,250 acres of good land near the sources of the Nimkish River, which "unfortunately is cut up into detached blocks by the mountain spurs and gravel ridges which run down to the extreme."

With the exception of some land on the upper end of the Salmon River, which will be afterwards referred to, the above is the extent of agricultural land in the interior which came under the observation of Mr. Mohun during a season's exploration.

Mr. Todd, a gentleman who has repeatedly crossed the Island, and who has seen "almost every portion of the land and all the rivers and streams south of a line drawn from Cowichan River to the mouth of Alberni Canal," writes:—"Beyond the present settlements there is no land fit for settlement except at the mouths of some of the rivers."

All the information procurable at the outset of my exploration, regarding the agricultural land, referred to that portion of the Island south of Fort Rupert, which I have described as principally occupied by the interior mountain ranges. Beyond the northern limit of these mountains, as may be noticed from the deck of passing steamers, the country to the northern extremity of Vancouver Island is comparatively flat, and I was in hopes that an exploration of this section would result in the discovery of a considerable amount of agricultural land. These expectations were not realized.

Having examined the east coast to within a few miles of Cape Scott, I crossed from Fort Rupert to Rupert Arm at the head of Quatsino Sound, and thence by the west arm, traversed the centre of the Island to within a short distance of its northern end, while explorations were also made from Rupert Arm southward. The area thus examined contains very little agricultural land. Near the east coast, patches of good land are met with, but they are so far apart as to render them practically useless for agriculture. The interior country consists of low, rocky and gravelly hills, generally thickly wooded, and interspersed with small swamps and lakes. Open tracts, which might be made available for pasture, are visible on the sides and summits of some of the hills.

The conclusion at which I have arrived from the foregoing evidence, and from other information furnished me by those personally acquainted with some of the localities referred to, is, that the interior of Vancouver Island is destitute of any inducement to agricultural settlement, but without long and laborious explorations it would be unwise to announce as a certainty that such is the case, and it may be farther remarked that, in connection with the vast and varied mineral resources, which are sure of development at no distant date, the area of cultivable land in the interior, small though it be, is of the utmost importance.

I will now proceed to utilize the information acquired during the examinations of last season, in estimating the agricultural capabilities of Vancouver Island; in doing which it will be convenient to observe the following divisions :—

1878

I. The Northern division, embracing the Island from Cape Scott on the north to a line joining Seymour Narrows and Nootka Sound on the south.

2. The Central division, extending southward to the Qualicum River and Alberni Canal.

3. The Southern division, embracing the remainder of the Island to the southward.

The area of the first or Northern Division may be taken at 4,100,000 acres, of which I estimate that there are cultivable :—

| | Acres. |
|---|---|
| North of Fort Rupert, including land in the interior, and on the west coast | 15,000 |
| On the Nimkish River | 6,500 |
| On the Cokish River and tributaries | 2,000 |
| On the Adams River | 4,000 |
| On the Salmon River | 25,000 |
| | 52,000 |
| Add for land in the interior, and on the west coast south of Quatsino | 25,000 |
| Total cultivable land in the Northern division | 77,000 |

Of this amount the land suitable for immediate settlement does not exceed 30,000 acres. The remainder is partly very difficult of access from the seaboard, and probably too high for successful cultivation, and partly situated on the north end of the Island, where the temperature of the soil is kept low by the cold northwest blasts which sweep across it from the North Pacific Ocean. In this division, a little cultivation has been done at Fort Rupert, and on the Chickseeway River a few miles to the southward.

The area of the second or Central division may be taken at 2,190,000 acres. It embraces the fertile and important settlement of Comox, and I estimate that it contains of cultivable land :—

| | Acres. |
|---|---|
| Bordering on Menzies Bay | 5,000 |
| Between Menzies Bay and Comox settlement, including land on Duncan and Campbell Rivers | 20,000 |
| In and near the Comox settlement, including land under cultivation | 5,000 |
| From Comox to Qualicum River | 7,000 |
| | 37,000 |
| Add for land in the interior and on the west coast | 20,000 |
| Total amount of cultivable land in the second division | 57,000 |

Of this amount 30,000 acres may be taken as fit for settlement. On the Duncan and Campbell Rivers there are patches of open land with considerable intervening stretches covered with light maple, easily cleared. In the Comox settlement most of the open land is occupied, but in the vicinity there is a large area lightly timbered, which might, at a comparatively small outlay, be brought under cultivation. From Comox to Qualicum River the country is mostly thickly wooded.

The area of the third or southern division is 2,670,000 acres, and includes the settlements of Nanaimo, Cowichan and Victoria and neighbourhood. The extent of cultivable land may be taken as follows:—

| | Acres. |
|---|---|
| From Qualicum River to Departure Bay, including land on Englishman's River and Nanoose Bay | 10,000 |
| Departure Bay to Oyster Harbor, including land under cultivation in Nanaimo settlement | 30,000 |
| Oyster Harbor to head of Saanich Arm, including settlement of Cowichan | 75,000 |
| From head of Saanich Arm to the Strait of Fuca, including the Saanich Peninsula. | 125,000 |
| | 240,000 |
| Add for land in the interior | 15,000 |
| Total amount of cultivable land in Southern division.. | 255,000 |

## ABSTRACT.

| | | |
|---|---|---|
| Extent of cultivable land in | 1st, or Northern division | 77,000 |
| " " | 2nd, or Central division | 57,000 |
| " " | 3rd, or Southern division | 255,000 |
| | Total extent of cultivable land in Vancouver Island | 389,000 |

It is safe to assume that of this extent, 300,000 acres are eminently adapted, in respect of situation and fertility, for remunerative agriculture.

The following table, exhibiting a summary of detailed information collected throughout the different settlements during the last season, is believed to be a near approximation to accuracy:—

## YEARS 1878 AND 1879.

| Name of Settlement. | Extent of Land occupied for actual Farming operations. | Extent under Root crops, and Product. | | Extent under Grain crops, and Product. | | Extent under Hay crops, and Product. | | Total extent under cultivation. | Total extent cultivable. | Annual value of Dairy produce. | Number of Persons engaged on farms. | Number of Cattle. | Number of Horses. | Number of Sheep. | Number of Swine. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Acres. | Acres. | Tons. | Acres. | Tons. | Acres. | Tons. | Acres. | Acres. | $ | | | | | |
| Comox | 5,719 | 96 | 830 | 216 | 208 | 433 | 706 | 745 | 3,628 | 9,903 | 126 | 809 | 43 | 70 | 363 |
| Nanaimo | 5,604 | 111 | 921 | 79 | 85 | 382 | 655 | 572 | 1,554 | 787 | 94 | 601 | 64 | 26 | 142 |
| Cowichan | 12,234 | 151 | 1,126 | 490 | 452 | 1,078 | 1,873 | 1,719 | 9,704 | 11,743 | 393 | 1,525 | 125 | 161 | 414 |
| Victoria and adjoining settlements | 28,073 | 280 | 1,996 | 3,450 | 3,093 | 1,985 | 2,994 | 5,715 | 18,684 | 12,385 | 652 | 1,965 | 432 | 5,381 | 1,593 |
| Total | 51,630 | 638 | 4,873 | 4,235 | 3,838 | 3,878 | 6,228 | 8,751 | 33,570 | 34,818 | 1,265 | 4,900 | 664 | 5,638 | 2,512 |

From the above table it appears that 1,265 persons are supported by and employed in the cultivation of 8,751 acres, but I am of opinion that the present farming population could, if the circumstances of the country either demanded or justified it, successfully cultivate an extent of land 50 per cent. in excess of that already under cultivation. This being the case, it is easy to see that with 300,000 acres of cultivable land, Vancouver Island could support an agricultural population of 25,000 to 30,000.

In reference to the soil of Vancouver Island, it may be said that it is uncommonly fertile and admirably adapted to the production of the various cereals and root crops, and instances are not wanting where the land, after having been cropped continuously for 15 years, with little, if any manure, is still yielding fair crops. Peaches, melons, tomatoes and grapes, ripen in the open air on the Saanich peninsula and other places, where the exposure is favourable, and the hop vine has of late years been successfully cultivated in several localities.

The following may be taken as the average yield per acre of land in good order:

| | | |
|---|---|---|
| Wheat | 30 to 40 | bushels. |
| Barley | 35 to 45 | " |
| Oats | 50 to 60 | " |
| Potatoes | 150 to 200 | " |
| Hay | 1½ to 2½ | tons. |
| Turnips | 20 to 25 | " |

I am assured by a gentleman farming in Victoria district, that his land has produced as high as 90 bushels of oats per acre; and in the Cowichan settlement I met with one instance, at least, where the yield of turnips per acre was fully 45 tons.

Through nearly the whole Island, excepting, of course, the mountainous portions, I believe cattle can support themselves at certain seasons on the undergrowth and pasture of the forests, but as partial stall-feeding is necessary during winter, I do not think that the pastoral advantages, apart from their being valuable auxiliaries to agriculture, are of much importance.

With respect to the climate I have the united testimony of the farming community, after a lengthy experience, that with due diligence and care on their part, the crops will always mature, and can be gathered in good condition; and a calamity such as the loss of crops from the waywardness of the climate is a thing unknown. This assurance obviates the necessity of attempting to establish the suitableness of the climate by scientific data.

It must be confessed that the tabulated exhibit of actual agricultural operations in the districts named, is chiefly remarkable for the smallness of results; and considering the age of some of these settlements, one is indeed forced to admit, what the farmers themselves admit, that it is still the day of small things in so far as agriculture on Vancouver Island is concerned. As will be seen, only about 11 per cent. of the available agricultural land on the Island has been taken up, while of the 33,570 acres taken up, only 26 per cent. has been brought under cultivation. It seems but right that some of the causes contributing to this state of things should be glanced at. They are not to be found in the soil, for richer soil nowhere exists; nor are they traceable to the climate, for that has been assured from long experience, while the farmers are thrify, energetic and industrious. They are chiefly as follows:—

The high price of farm labour. The distance, and in some instances, the indifferent communication between field and market, and consequent margin necessary to cover high freight charges, wharfage and middle men's profits.

The fact that when the market is reached, it is often found to be glutted by surplus produce sent in from adjacent United States territory, at less expense than Island produce.

A large majority of those resorting to British Columbia, having come to mine for the precious metals, comparatively few have been found willing to betake themselves to the less exciting occupation of agriculture.

With an increase of population, and the consequent competition in labour as well as in the productions of the soil, these disadvantages will disappear, and I am confident that Vancouver Island possesses sufficient latent agricultural resources to furnish, when utilized, a substantial element in contributing to the future prosperity of British Columbia.

With the exception of a few openings, Vancouver Island is densely wooded from end to end. The most valuable varieties of timber, in a commercial view, stated in the order of the importance, are the Douglas fir, the red cedar, the white pine, and the spruce fir.

The first named, sometimes growing to an enormous size, is found throughout the Island, but more plentifully in the southern and middle districts. It gradually disappears up to latitude 52° N., beyond which it is seldom seen. The red cedar and spruce fir are widely distributed, but are most abundant near the sea coast. The white pine is confined to particular localities, generally inland, to which access is difficult.

On nearly every inlet on the west coast, valuable timber tracts have been found, Alberni Canal and Quatsino Sound seem to be especially distinguished for the excellence of the Douglas fir and spruce, with which their shores are lined. The same varieties are found in abundance on the east coast, from Menzies Bay to Comox, and on the rivers that fall into the Strait of Georgia, between these points.

On the higher portion, of the valley of Campbell River and on the Comox River, in addition to extensive tracts of fir and spruce, there are considerable quantities of white pine. Lumbering operations are being carried on to a considerable extent between Comox and Nanaimo, mostly in the vicinity of the coast.

On the Nanaimo River, I am informed by a practical lumberman, there are sufficient fir, spruce and pine to afford ten years' employment to a large lumbering camp.

The lower portion of the Chemainus River valley, in the Cowichan district, is covered with the finest timber, and I have been informed by the Hon. Mr. Smithe that, for thirty miles or more upward, this valley contains large quantities of excellent fir and spruce, while on the higher portions of the country, in the vicinity of the river, are considerable areas of white pine.

On the Cowichan River and Lake it is estimated that there is timber enough to produce two thousand million feet board measure of marketable lumber.

These are all the localities which seem to merit special notice as abounding in timber of a serviceable character. On nearly every part of Vancouver Island more or less marketable timber can be found, a fact which certainly adds greatly to the value of its industrial resources.

I am, Sir,
Your obedient servant,
JOSEPH HUNTER.

Sandford Fleming, Esq., C.M.G.,
Ottawa.

# APPENDIX No. 9.

## MEMORANDUM ON THE QUEEN CHARLOTTE ISLANDS, BRITISH COLUMBIA, BY GEORGE M. DAWSON, D.S., A.R.S.M., F.G.S., ASSISTANT DIRECTOR, GEOLOGICAL SURVEY OF CANADA.*

The Queen Charlotte Islands form a compact group, separated from the mainland and its adjacent islands by wide water-ways, *viz:*—to the north by Dixon's Entrance from the southern extremity of Alaska, to the east by a strait called Hecate Strait on some recent charts, from the mainland of British Columbia. The mountain range forming the axis of these islands lies in a north-north-west, south-south-east bearing, and is the northerly continuation of that of Vancouver Island and the Olympian Mountains of Washington Territory. The extreme length of the islands from Cape St. James to North Island is one hundred and fifty-five geographical miles, the width, at right-angles to the bearing above given, in one place about fifty miles. The area, owing to the uncertainty in longitude of points on the western, as compared with the eastern coast, cannot be given with any accuracy.

The group consists from south to north of three large islands, named Prevost, Moresby and Graham Islands, but also includes many smaller islands, islets and rocks. The separation of the larger islands may be said to be accidental, as it does not depend on any great structural feature, but on the casual inosculation of inlets or fiords, which characterize both the eastern and western coasts. The higher parts of the mountainous axis of the islands is included between latitudes 52° 30′ and 53° 20′, extending from Juan Perez Sound to some distance north of Skidegate Inlet. Mountains estimated at 4,000 feet in height are here numerous, and carry on their northern sides pretty extensive patches of snow throughout the summer. A few peaks probably reach 5,000 feet in elevation. It is doubtless to this part of the range that the name Sierra de San Cristoval was applied by Juan Perez, the discoverer of these islands. To the south the mountainous axis decreases in elevation, summits exceeding 2,000 feet being quite exceptional about Houston Stewart Channel. To the northward the range also continues with decreased height, and becomes diffuse. At the head of Masset Inlet few of the mountains appear to exceed 1,500 feet, and their forms are rounded; near North Island, the hills do not surpass a few hundred feet.

From the southern extremity of the islands to Cumshewa Inlet, on the east coast, there is little flat land, and probably none suited to agriculture, though the Indians cultivate small potato-patches in a number of places close to the shore. The shores are generally bold and rocky, and often plunge into deep water without any beach The whole surface of the country, even where its rocky character would seem most unfavourable to vegetation, is densely covered with coniferous trees, which, in sheltered valleys—especially on the eastern coast—frequently attain a large size. The eastern coast, in this part of its length, was found to be dissected by inlets in a manner not indicated on the sketch which has formerly appeared on the chart. These are for the most part deep and fiord-like, and often walled in by high mountains. The western coast of this part of the islands is probably similar in character, with many inlets not yet explored.

The promontory between Cumshewa and Skidegate Inlets is low, nearly level, and densely wooded with trees which in some places are of very fine growth. The shore forms two or three shallow bays. It is low and strewn with boulders, and flats are bared at low tide a long way off. Skidegate Channel, separating Moresby and Graham Islands, is very narrow for some miles, with many rocks, and is in fact nearly dry at low water for a considerable distance, and therefore quite unsuited as a passage for anything larger than a canoe or boat. From the low land found near the southern entrance to Skidegate Inlet, the mountains gradually increase in elevation to the centre of the islands; beyond which, toward the west coast, though rugged and with scarcely a vestige of soil, they seldom exceed 2,000 feet in height.

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* Transmitted for publication in advance of the forthcoming detailed report on the explorations of 1878, by permission of A. R. C. Selwyn, F.R.S., F.G.S., Director, Geological Survey of Canada.

Graham Island may be divided into two differently characterized regions by a line drawn from Image Point, Skidegate Inlet, to the mouth of the Jal-un River on the north coast. To the south-westward of this line, is a country hilly and even mountainous, but so far as observed almost always densely forest-clad, with trees which attain a large size where not too much exposed. North-eastward lies a low, flat or gently undulating country which probably seldom exceeds 300 feet in elevation, and is based on wide-spread drift deposits and rocks of Tertiary age. This country is also densely wooded, the trees often attaining magnificent dimensions. The coast from Skidegate to Rose Point or Nai-koon and thence to the entrance to Masset, is generally low, to the eastward often marked by cliffs of clay and sand, but fringed always by a sandy or gravelly beach, on which the Indians frequently walk from the Masset villages to that of Skidegate. Between the shore and the edge of the forest, is generally a zone of grass-covered sand-hills, produced by the action of the wind in heaping together the sand from the shore. These would form good grazing lands, but are unsuited to agriculture. With this exception, and that of swamps, there appears to be no part of the country free from forest. The coast between Skidegate and Masset being exposed, without harbors, and shoal, is dangerous of approach by vessels, but the wooded country is rendered accessible by Masset and Virago Sounds and their connected waters.

The well-known Douglas fir does not occur on the Queen Charlotte Islands, finding its northern limit on the outer coast at the north end of Vancouver Island. The forest is chiefly composed of Menzies spruce (*Abies Menziesii*), the western cedar (*Thuja gigantea*) and the western hemlock (*Abies Mertensiana*). The yellow cypress (*Cupressus Nutkatensis*) also occurs, though seldom in large groves, and generally scattered over the more barren and rocky portions of the hill slopes. Of the trees above mentioned, Menzies spruce, the cedar and the cypress are the most valuable for lumber, and though the first named is not considered equal to the Douglas fir for most purposes, it must ere long become valuable, and can be obtained of excellent quality, and in almost inexhaustible quantity in these islands. Skidegate Inlet would be convenient in many respects as a site for saw-mills, but Naden Harbor, or Masset, are better situated for this purpose, affording easy access to a large area of wooded country.

The great growth of the trees and the comparative immunity of the woodland from forest fires depend, in great measure, on the damp character of the climate of the islands, which is also evinced in many other ways. The heaviest rain-fall is, however, local, taking place on the western mountainous axis; and it may often be noted that while heavy rain is there falling, the sky is comparatively clear over the strait to the eastward. From this circumstance the triangular area of low land forming the north-eastern part of Graham Island is not subject to an extremely heavy rain-fall, and would appear to be well suited to agriculture, but for the dense forest covering, which at the present time it will not pay to remove. The Hudson Bay Company have a post at Masset, where for some years cattle have been kept, or rather have kept themselves, grazing on the sand-hills in the vicinity of the coast and requiring no attention summer or winter. Between Masset and Skidegate a considerable number of animals might live in this way, and it has been proposed to winter mules and horses from Cassiar in this country. In winter the rain-fall in the islands is generally very heavy, with persistently overcast sky, and gales more frequent and violent than those experienced on the coast further southward. Snow occasionally falls to a considerable depth, but does not lie long, except in the mountains. In the winter of 1877-78 no snow fell on the low lands. In that of 1878-79 snow lay on the ground at Masset for about a month, and it was the most severe of which the natives had any knowledge.

Various attempts at mining have been made in the Queen Charlotte Islands, but have so far all proved unsatisfactory. The first of these was in 1852 at Mitchell, or Gold Harbour, on the west coast of Moresby Island, whence specimens of gold were brought by the natives. These falling into the hands of the Hudson Bay Company, an expedition was sent to examine the locality. A considerable quantity of gold was obtained, but the vein, which was small, eventually disappeared entirely, and though a number of miners have subsequently "prospected" the locality, nothing further of value has been discovered. There are no alluvial deposits, and owing to the wooded character of the country it is difficult to examine farther than the shores. The rocks of this part of the islands appear, however, to be similar to those abundantly represented elsewhere, especially to the south and east, and it is not unreasonable to suppose that other valuable auriferous localities may yet be found.

At Skidegate a large sum of money has been spent in endeavouring to open a coal mine. The coal is anthracite and of excellent quality, but the seam where examined is rather thin and irregular. Had more attention been devoted to tracing the seam from point to point on the surface its true value would now be better known. The horizon which the coal occupies is a clearly defined one, and the general fact that it continues to show more or less anthracite has been proved in several localities many miles apart. Till further explorations of a practical character have been carried out, it will be difficult to speak definitely of the value of the region. It may at least be said to be promising, and in view of the importance attaching to the possible discovery of extensive deposits of anthracite on the Pacific coast, worthy of further attention. The total quantity of coal so far extracted amounts to about 800 tons.

Rocks of the coal-bearing formation occupy the north shore of Cumshewa Inlet, and the greater part of both shores of Skidegate Inlet, and extend thence indefinitely north-westward. They are found again at the north-western extremity of Graham Island and on North Island, but somewhat changed in character, and with no appearance of coal; which, in the form of thin seams, and small rounded masses included in sandstone, is not wanting in many places in Skidegate and Cumshewa Inlets. The rocks, from attitudes nearly or quite vertical in the vicinity of the mountainous axis, where the anthracite has been found, become gently undulating and nearly horizontal eastward, where, should coal be discovered it may probably be found to be bituminous.

Lignite coals of Tertiary date have been found in the upper part of Masset Inlet, at Skon-un Point on the north coast, and near the entrance to Skidegate Inlet. These, however, in a country so abundantly supplied with wood are comparatively unimportant.

Traces of copper ores, in some cases associated with galena, have been found in a number of places. An attempt to work a deposit of copper has been made at Skincuttle, and a second at Copper Bay, between Skidegate and Cumshewa Inlets. The latter appears to be the most promising locality. Many others may eventually be found as the islands become better known.

An apparently important deposit of magnetic iron ore occurs at Harriet Harbour Skincuttle Inlet. Specimens collected here have proved rich on analysis, containing from 58 to 69.8 per cent. of iron.

The fur trade, and more particularly the trade in the skins of the sea-otter, first brought the Queen Charlotte Islands into notice, and toward the end of the last century these islands and the adjacent coasts were frequently visited by vessels sailing under the English, American and other flags. The natives, stimulated in the pursuit of the sea-otter, soon rendered it extremely scarce, since which time few vessels but small coasters engaged in Indian trade have resorted to the islands. The fur trade is now comparatively unimportant. Sea-otter skins are still obtained in small numbers, with those of the fur-seal and a limited number of skins of the black bear, martin and otter.

The natives of the Queen Charlotte Islands, known as Haidas, live almost entirely on fish, especially halibut. To the north of a line drawn from the entrance of Skincuttle Inlet north-eastward across Hecate Strait, the depth of the water never exceeds 100 fathoms and is generally very much less. A similar shallow area, with a probable width of ten or twelve miles, borders Graham Island to the north, and it is also probably comparatively shoal for some distance off the west coast of the northern part of the same island. These banks, swept by strong tidal currents, with the shore lines of the inlets and fiords, constitute the feeding-grounds of the halibut and other fishes, and by their exceptional extension account for the great abundance of fish to be found in the vicinity of the islands.

The halibut is the most important, and though it has not yet been found marketable either salted or canned, if means were adopted by which it might be carried in a fresh state to the southern markets, an extensive fishery might be maintained.

The dog-fish, found in great abundance, is taken for the manufacture of oil, and a small establishment is already at work in this business at Skidegate, besides less systematic operations by the Indians.

Salmon of two or more species run up many of the streams in large numbers, especially in the autumn. They are taken by the natives in weirs and by spearing, but as none of the rivers are large the opportunities for establishing canneries are not so good as in other parts of the Province. Herrings are very abundant in some places, especially in the vicinity of Skidegate at certain seasons. A species of pollock or coal-fish is caught in large numbers in deep water in some parts of the west and north coasts of the islands. It is prized by the Haidas as a source of edible oil which some tribes use instead of that of the oolachen. The latter fish does not occur in the vicinity of the islands. Flounders and plaice abound in some localities. A true cod, probably the same species as that for which vessels sail from San Francisco to the Okhotsk Sea, is found, but is not sought after by the natives, though it may occur abundantly on some banks at certain seasons. The same remark applies to the mackerel, of which a species is found. Smaller fish, such as the various species of rock-cod and the shell-fish, which form at times, an important item in the native dietary, it is unnecessary to mention particularly.

There are many good harbours in the islands. Of these Rose Harbour on Houston Stewart Channel is the most southern, and is easily entered either from the south or west coasts. Harriet Harbour, on Skincuttle Inlet, is a good anchorage, with an average depth of eight fathoms. Echo Harbour, on Darwin Sound, is small but remarkably well sheltered, the depth being from ten to fifteen fathoms. Rock-fish Harbor, on Selwyn Inlet, is easily entered and well land-locked; depth from thirteen to twenty fathoms, with an anchorage for small craft in less water. The entrance to Cumshewa Inlet is over a bar on the north side, which, according to the sketch published by the Admiralty, has a depth of seven fathoms. Skidegate Inlet has been carefully surveyed, and a map is published by the Admiralty. The entrance is protected by a bar through which two channels pass with least depths of eleven and three and a-half fathoms respectively. Masset Sound must be approached with caution, till a complete survey shall have been made of it. Virago Sound appears to be an excellent harbour, and within the bar—on which three to three and a-half fathoms is found—it opens to Naden Harbor, a fine sheet of water, with an average depth of about ten fathoms, and completely land-locked. On the west coast Port Kuper has been surveyed, and a sketch of it published by the Admiralty. Tasoo Harbour, further south, is reputed to be extensive, and there are probably other anchorages yet undiscovered.

The Haidas, or natives of the Queen Charlotte Islands, probably now number scarcely 2,000, including all who call the islands their home, even though seldom residing there. They are of the same race with the Kaigani Indians of the southern part of the Prince of Wales Islands of Alaska, who, according to a recent estimate, number 300. Though unfortunately much demoralized, owing to the habit of frequenting Victoria and other towns, the people are naturally more intelligent than most of the natives of the coast. They appear to be peculiarly apt in the simpler mechanical arts, and are expert and bold canoemen. They are frequently employed on coasting vessels, and would be of essential service as assistants in mills or fisheries established on the islands. No steps have yet been taken to do away with the Indian title to the lands of the Queen Charlotte Islands. Small tracts of land have been secured by special purchase in several instances, but owing to the strict ideas of ownership among the Haidas, the manner of the abolition of the Indian title may be a difficult question.

VICTORIA, B. C.
30th May, 1879

GEORGE M. DAWSON.
D.S., A.R.S.M., F.G.S.

## APPENDIX No. 10.

### NOTES ON THE ROUTE OF THE CANADIAN PACIFIC RAILWAY THROUGH BRITISH COLUMBIA, BY MAJOR-GENERAL MOODY, R.E., FORMERLY COMMANDING ROYAL ENGINEERS IN BRITISH COLUMBIA.

These notes have reference to the following considerations, viz.:—

1. Overland transit of commerce, and passengers to and from Asiatic and other countries.
2. Dominion requirements as to extended occupation of Dominion, and development of its permanent interests.
3. Cost of construction with cost of maintenance.
4. Revenue towards meeting cost of maintenance and interest on borrowed capital, including as part of capital the accumulation of annual cost of maintenance that shall not have been covered by revenue.
5. Pacific terminus.
6. Imperial and especially Dominion interests under a possible temporary condition of war.

These notes are confined to the part of the Dominion extending from the Rocky Mountains to the Pacific.

Attentively considering Mr. Sandford Fleming's two reports, 1877 and 1878, and also his admirable paper read before the Royal Colonial Institute; and having gone through the other valuable reports and communications accompanying his reports; recalling also my own local impressions as to some of the most material points, I arrive at the same main conclusion as Mr. Sandford Fleming in his report of the 26th April, 1878.

On some matters I have been led, by local knowledge, to be more optimist than Mr. Sandford Fleming.

Three routes are considered.

I. Terminatimg in Port Simpson.

II. Terminating at head of Bute Inlet, or with continuation down Bute Inlet to Frederick's Arm, thence by water (ferry) to Vancouver Island, and down east coast of Vancouver Island to Esquimault.

III. Terminating in Burrard Inlet, or with addition of crossing by water (ferry) to Nanaimo, and from thence down east coast of Vancouver Island to Esquimault.

If shortness of distance to and from Asiatic countries is to outweigh all else, the northern Route I, terminating in Port Simpson, would, no doubt, be found the best for quickest transit of commerce and passengers.

For the development of the permanent interests of the Dominion, and for revenue, there can scarcely be a doubt this Route I would be found inferior to either of the other two.

The cost of this Route I has not been estimated, but its length has been approximately ascertained. Its Pacific terminus may be considered sufficiently satisfactory.

Of the three routes it is the only one that may be considered secure from desultory attacks, but being so far north, it would be of comparatively small avail in defence of the Province. It is to be noted also—under this consideration—that the port adjoins Alaska, United States Territory; with the corresponding disadvantages and advantages in war.

### *Route II. (No. 6 of Reports.)*

It is evident that Route II, in any comparison with the other two routes, must be taken as terminating at Esquimault.

As a practical question it should not be viewed otherwise, nor is it so; all, in truth, consider it as to pass downwards to Esquimault. To consider it as stopping at the head of Bute Inlet, would in any comparison be parallel to considering Route III as stopping at Yale or Hope, the head of navigation on the Fraser.

This Route II, terminating at Esquimault, is 287 miles longer than Route III, terminating at English Bay, outside Burrard Inlet.

Computing total distances to Asiatic countries it would be 217 miles longer.

Under consideration of extended occupation and development of permanent interests of Province and Dominion, the southern and best portion of the Province would be altogether disregarded by this Route II. This point will be further noticed under Route III.

As to cost of construction, with cost of maintenance, the difference is something immense. It appears the cost of construction of this Route II would be $20,000,000 (rather more than four million pounds), greater than Route III, carried down to English Bay, outside Burrard Inlet.

The cost of maintenance would be proportionate. It appears that, if the present traffic of Intercolonial Railway be taken as a datum for comparison, the annual cost of maintenance of the Route II, terminating in Esquimault, would be about $693,000 (about 145,000 pounds) per annum, greater than the annual cost of Route III, terminating at Coal Harbour inside, or English Bay outside Burrard Inlet.

While the difference of annual interest on cost of construction, added to annual difference on cost of maintenance, amounts to something so extremely great, there are no safe grounds for hoping for a compensating amount of revenue.

The difference of revenue either way will probably not be great, and most assuredly for many years to come the revenue from the British Columbia portion of the overland line cannot be expected to be very large.

Assuming branch lines to be constructed to either, I am under the impression the total of revenue will be found to be in favor of Route III.

With respect to the Harbour of Esquimault, no observation is necessary; all admit its excellence.

It would be a mistake to assume that in time of war, this Route II (line 6 of reports) would be secure from desultory attacks and injury from an enterprising enemy, thoroughly acquainted, be it remembered, with every spot of that region, land and water, and perfectly familiar with all local circumstances of tides, weather, currents, fogs, &c., &c.

The ingenuity and the enterprise of such possible enemy would not be less than our own similar qualities, both in repelling and in acting in like manner on their own ground and in their own adjoining waters. Risks of temporary injury must be looked for on both sides, though they would be duly prepared against, as far as possible, by suitable pre-arrangements afloat and ashore.

I am inclined to think the line down from head of Bute Inlet, 50 miles, uninhabitable, and close along shore, with tunnelling here and there and other costly works; then 15 miles of ferry to Vancouver Island; and thence down the coast of Vancouver Island, 183 miles, to Esquimault—248 miles in all—would be found more liable to risks of injury, and in more places, and some much more difficult to repair, than the line from Hope downwards 60 miles to Burrard Inlet, through a densely occupied district, organised for defence with a broad and defensively occupied river to cross.

In either case, however injuries could be either more or less readily restored by arrangements previously systematized for that purpose by a disciplined local corps of Volunteer Engineers.

While this Route II (No. 6 of reports) cannot be deemed secure from injury, it passes so far from the frontier and all the southern districts of the Provinces on the mainland, that for defence or (if desirable) counter-attack its aid would be very limited. It would be very valuable as a second line of support, and some future day it is to be expected the increasing development of the Province will justify its construction.

## *Route III. (No. 2 of Reports.)*

Route III (No. 2 of the reports), terminating in Burrard Inlet, is, no doubt inferior to Route I, terminating in the extreme north of the Province in Fort Simpson, as to quicker transit from Asiatic countries, but not to such a degree as to outweigh its manifest advantages under the condition of the Province for a very long time to come.

It is not improbable that by the general direction of this line, Route III, and its so passing down to Burrard Inlet, some addition to general overland traffic may be gained from the United States' side of the frontier, including in that some of the over-sea Pacific traffic of the United States.

The United States' partially-executed North Pacific line, when completed and with its branches up to the frontier, will be expected to counteract this, no doubt; yet, the advantages of shorter distance, with less expense, may eventually tell, in some degree, in favor of the Canadian Pacific Route III for a portion of this traffic, under some future international bonding and through-transit engagements.

It is also evident that, to the gain of the railway and to the Province at large, trade, mutually profitable between the Dominion and the United States, all along the frontier from the sea to the Rocky Mountain range, would be fostered and expanded by this line (Route III), and not be confined alone to trading coasters from ports in Vancouver Island to ports in the United States. Such development would tend to settle up both sides of the frontier, to the gain and prosperity of all that region, Vancouver Island included.

By Route III, the interests of the part of the Province included in Vancouver Island are as fairly regarded as the rest of the Province; while by Route II, the whole of the south portion of mainland, from Rocky Mountain range to sea coast, would be disregarded.

One must keep in mind that if Route III did not exist, the material interests, present and future, of this valuable south portion of British Columbia, from the seaboard to Rocky Mountain range, would gravitate inevitably to the foreign branch lines of the United States' North Pacific Railway; such branches coming up from south to different points along the frontier, east and west of Cascade Range.

The coast branch up, from the future great and important port of Holme's Harbor (United States), in the Straits of Georgia, to Semiahmoo Port (United States), 45 to 50 miles, will reach to about 15 miles from New Westminster, and, as a matter of course, in the progressive interchange of trade and communications between the two nations, will extend to New Westminster.

Another branch will probably also reach a point higher up the Fraser, nearer Hope.

In the absence of such line as Route III terminating in Burrard Inlet, the results, as stated above, are self-evident. It cannot be otherwise; they would be ruled by the irresistible law of self-interest. Self-interests becoming strong, established in such direction during peace times, it needs but little sagacity to foresee how great the strain on the sense of duty might be during a period of war amid what would then be a more or less mixed population (however loyal) with material interests directed southwards.

Any results as above would not only be effectually counteracted by line, Route III, but, as before stated, additional gain may be looked for from over the border.

Let it be borne in mind also that nothing north of Route III can be drawn away anywhere else but to branch lines upward from Route III, and to any northerly lines formed within the Province itself, from the coast, and connecting with the main overland lines somewhere.

It seems evident that the interests of the Province may be expected to be consolidated and advanced, together as a whole, and in communion with the Dominion, better by Route III than by Route II or by Route I.

The configuration of the country prevents such a perfectly satisfactory main line of direction as on the east of the Rocky Mountain Range, but thanks to the skill, intelligence and perseverance of the engineers, it is a very good one indeed, as a glance at the map will show, and far better than could have been looked for across such a difficult country.

It is also to be hoped that branch lines, north and south, will follow early, giving facilities for inducing occupation of promising tracts of country suitable for permanent settlement—I mean that shall be permanent when mining interests and their needs may begin to wane. It is very certain, however, that metals (precious metals included) exist, may almost be said to abound, in many parts of the Province, though at present, the Cariboo district is the one worked.

For many reasons of great importance to the Dominion, as well as to the Province in particular, it is extremely desirable at the earliest period, with the main line on the mainland, to construct also a railway (68 miles) from Esquimalt to Nanaimo, as a Dominion undertaking; and that every means of encouragement be also given inducing a dense settling up of the east side of the Island, equally so with all the south portions of the mainland, especially the portion from the coast to Yale on both sides of the Fraser.

### *Soil and Climate.*

As to soil and climate, and general fitness for agricultural and pastoral occupation, it is a subject that would require a series of notes apart from these.

As coming from myself, it may be sufficient for me to make the few following observations:—

The district on the mainland on both sides of the Fraser, from coast to Hope, traversed by Route III, taken generally, and the land suitable for occupation on the east side of Vancouver Island, taken also in the same general way, are quite on a par with each other; there will be found no difference either way of any moment.

On the mainland the winters, though not longer, will, as a rule, be found somewhat of a lower temperature than on the Island, though brighter; the summers in some degree warmer, and as clearing and occupation progress, with rather more settled weather.

Careful and daily (at regular hours, 9.30 a.m., and 3.30 p.m., and maximum and minimum, day and night) meteorological observations of every description, with excellent instruments, gave advantages for forming an opinion of the meteorology at that time of this part of the lower Fraser.

In both these districts, on Island and on mainland, there are—as might be expected—places varying from each other in climate and soil. From the configuration and position of Vancouver Island it will probably be found that the local variations there are the more numerous.

Decidedly advantageous as both districts are at present for dense settlement, they will be still further improved as much of the forests are cleared, marshes drained, rivers embanked and soil cultivated. It is of universal experience how remarkably great and beneficial are the changes, in all new countries, produced by such operations.

In the above-mentioned district on the mainland, the periodical annual rise and fall of the River Fraser for the short period in summer was carefully observed. The dates and height to which it gradually rose, and then as gradually receded, were remarkably uniform, and could be relied on almost to a day, and to a matter of inches day by day.

It would be a misapprehension to be under an impression that such portions as are covered by the rise of the river, and then only for a short while, form an appreciable area of the whole, or that such area is covered to a considerable depth.

Patches and margins here and there are deeper than the rest, and water-courses and "slues," dry for the remainder of the year (even in depth of winter), are filled to the full. This latter circumstance will be found to be a considerable advantage, and just at the very time most wanted.

It should also be noted that the river, during the period it is rising and gently overflowing portions of the low-lying meadow lands, deposits a sediment of great value. Embankments that should be made, and will be made, should be so contrived as to accept the flood-waters at will and allow the deposit, and then to pass off during or after the subsiding of the flood. In short, to carry out what is known as "warping."

It should not be forgotten that, as these lands are embanked, the final height of rise of river will be increased proportionately.

Allowance for this should be made in the height of the embankments and in quays and jetties along the river banks.

It will be found that the owners of these very lands will value them probably at the highest figure of all their lands.

The character of the region from north to south, between Cascade Range and Rocky Mountain Range has been described by others.

Differences of opinion as to localities doubtless exist according to information given from this or that quarter, but in the main such differences are not material. I think, however, it will be found that the extent favorable for close "settling up," in either agriculture or pasture, in the southern half is greater than it appears is at present assumed, and that the climate is superior and on the whole more favorable to such occupations (particularly as settlement goes on) than the more northerly districts. Both, however, can be justly recommended for settlement.

That this should be received with some hesitation by persons not long personally acquainted with the country, and not having had experience there in a persevering cultivation of the soil and in rearing stock, is not at all to be wondered at. It will demand not a little faith by those living in the same parallels of latitude in Europe to believe that wheat will ripen anywhere at all, at altitudes from 2,500 to 3,000 feet, and other grain at even more. They will find it difficult to accept the truth that in a country known to consist mainly of high plateaux, bounded and streaked with lofty mountain ranges, dotted with vast forests, can in such northerly latitudes, be blessed with such continuous sunshine and high summer temperature. Nevertheless such is the fact.

In other countries besides British Columbia it has been found at first difficult indeed to reconcile such facts with previous experiences elsewhere.

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The cost of constructing this Route III (No. 2 of reports), terminating in Burrard Inlet, has been shown to be $20,000,000 (four million pounds) less than Route II (No. 6 of reports), and the cost of maintenance will be also proportionately less.

It is to be noted also that from water carriage of considerable extent and existing roads being both available, this Route III can be conveniently and economically constructed in portions along the line, and such portions be at once used by the public as well as by the engineers for the further construction between and onwards.

The economy thus to be gained by Route III in various important items must be very great. It has been considered in the estimate.

The special advantage on this line of being able to complete and bring into use sundry portions only, will also bring earlier revenue, and also encourage and facilitate earlier settlement. The remunerative advantages to the Province of all this will be found much greater and much sooner than may at first, perhaps, be supposed. There will be an accelerating ratio of collective gain, both to Province and railway.

The above, coupled with the immense difference of cost of construction and cost of maintenance, form altogether an overwhelming consideration in selecting this Route III. The more so as there can be no doubt, even under the most hopeful view, and with branch lines early added, water communications established and waggon roads formed, all reaching to and opening up every suitable district for settlement, it will be a long time to come in that Province before a balance can be effected between revenue and the cost of maintenance, with interest on the capital borrowed for the construction of the railway, met in the meanwhile, it is to be presumed, by some form of Dominion taxation.

Were it not for the great advantages to be gained to the Dominion at large by the overland line, considered as a whole from end to end, the cost of overcoming the difficulties on the Pacific side of the Rocky Mountain range would probably have deferred the construction of that portion to some indefinite future time.

In reference to the approaches to the Pacific terminus of Route III at Burrard Inlet, the opinions which have been expressed by naval authorities are very properly guarded. Their responsibilities in giving opinions on such a matter are great. They point out everything fully; they counsel caution and attention; they do not condemn.

Happily also for the public service, carefully accurate surveys and full charts, on a large scale, have been made by the Royal Navy, and are published and are also accompanied by equally full pilot instructions, published and accessible to every one.

The Admiralty have accorded an invaluable service to British Columbia in having caused this to be done.

The main channel and inner channel and all the water-ways are now thoroughly well known, and the first used by vessels of any class or size. It is the one preferred. Pilots, if wished for, must also by now be many in number.

Suitable steam-tugs will, no doubt, be soon forthcoming for such vessels as may need them.

Very numerous proofs have now accumulated of the perfect practicability of the route to Burrard Inlet for vessels of the largest tonnage engaged in commerce to and from any part of the world.

For sundry reasons—of commerce chiefly—it may be found convenient, both now and hereafter, for many vessels of all classes to discharge cargoes in Esquimault for transhipment elsewhere, mainland included.

Of the excellence of that harbor, no difference of opinion exists; and also of its convenient position for the needs of Vancouver Island, and for communication from thence, with other distant ports, and to several nearer ones also. It will always receive its full share of prosperity, and fortunately is a friend conveniently at hand to any vessels, large or small, trading past it upwards to other ports in the straits (such as Burrard Inlet, for instance) needing at any time shelter for the moment.

It is possible also that, for a while, it may be found convenient, in respect to the overland communication, for passengers and light goods to be transhipped at Esquimault into local fast steamers alongside, and sent on at once to Burrard Inlet terminus, and for heavy goods to follow in other heavy steamers.

It is also to be noted that civil engineering of sundry kinds, successively from time to time undertaken, can, at no extreme cost, further improve the channels, both the main one and the inner one. The immense strides in practical applications of science, all will aid in the same direction. Electric lights also used when and where found desirable, and so on.

It is to be expected the construction of the railway between Esquimault and Nanaimo will not be long delayed; and one may feel sure the engineering experience and skill advancing so rapidly in these days will be found able to devise and construct a suitable form of ferry vessels (double vessel, probably) that shall be of size sufficient [to convey short trains across to and from Burrard Inlet and Nanaimo in safety in almost any weather. Electric lights on board and ashore, used on occasions when desirable. There is ample depth of water at both termini.

It may be found advantageous hereafter to carry out such an arrangement, but again, it is not a necessity, on account of the nature of the channel.

With respect to Burrard Inlet generally, whether the outer harbor, English Bay, or inside in Coal Harbor, or at Port Moody, all are approved of, and they are, each of them, capable of further improvement for requirements of almost any magnitude. Port Moody is the least convenient, but from the chart it would seem that none of the three have less total area of anchorage than Esquimault, and that they possess adjoining extensive additional capacity. In fact, the whole inlet may be considered as a port.

At English Bay a strong pier of some length would be required. It would probably be constructed of timber. Plenty of the best material and of any scantling is close at hand.

Taking all points into full consideration, it will probably be found best to select a terminus within the inlet.

I do not know that direct contrary opinion as to the "approaches" from outer ocean to Burrard Inlet has ever been expressed. The differences have been solely of degree and other contingencies, which may, after all, be provided against.

On the engineering points connected with this matter, such as the affording increased facilities and the carrying out sundry improvements at any time, there can be no material difference among engineers.

The loss of San Juan Island is much to be regretted on many grounds. It, of of course, strengthens the position of an adjoining foreign power in case of war, but it does not necessarily give such possible enemy the actual command of the water-way. The inner channel is practicable and can be further improved. The nearest point at which vessels would have to pass, by inner channel, is five miles from the position on which an enemy might probably place a shore battery. It is assumed vessels would pass under steam or be towed.

It is to be observed, also, this inner passage is not without the advantage of well placed covering positions for defensive batteries.

The distance between such covering defensive positions and assumed positions in opposition is from two and a half to three miles.

Hostile vessels in passing through main channel could pass at two miles distance, but seeking to force inner channel would have to "run the gauntlet" of many positions half a mile distant on either side, and some nearer still.

It may be assumed the effective range of artillery will continue to increase as time goes on; but by the inner channel, even then, it seems evident fire from hostile shore batteries may be disregarded.

In reference to passage from Vancouver Island to the mainland, in a temporary contingency of war, notice does not appear to have been taken of the advantages of Saanich Inlet. There possibly may be (I do not know that it is so) sundry drawbacks to the general utility of this inlet under ordinary circumstances, but, under the temporary incident of war, a transhipment by short railway (made early) from Esquimault to head of Saanich Inlet (a distance of about eight miles, and commencement of projected railway to Nanaimo) would altogether avoid both the main and the inner channels, passing the San Juan group of islands.

This would offer a convenient alternative during such temporary period. Its construction at once would not be a large expenditure, and would be in furtherance of the railway projected between Esquimault and Nanaimo.

On completion of the railway through to Nanaimo, still further advantages, as an alternative, in time of war would be gained.

It has already been observed that a railway by Route II and also by Route III would, in war with an energetic enemy, be liable to risk of temporary injury in places for a certain distance along either, and that such injuries could be readily restored by arrangements previously organized. It is to be expected also that effective armed arrangements, both afloat (on Fraser as to Route III) and ashore, would be in operation to watch, to repel and to counteract an attack. The Province of British Columbia would not be the only part of the Dominion or of the world where railways are within a distance accessible to temporary injury by an enemy, but such liability is not deemed a bar to their being so located. Nor should it be forgotten that in the operations of war there are two sides to the question. Railways so placed, while open to risks, are of aid in defence, and are of avail in combined forward movements.

Such a base of operations as a navigable river, a railway not far distant running behind it, and a tolerable breadth of country (in possession) along the front of it, with both flanks secured—sea, occupied, on one side and lofty mountains on the other—is not without very considerable advantages.

It may be noted here that between Hope and Burrard Inlet, about 60 miles, the depth of frontier from whence raids might be expected would be about 30 to 40 miles.

From neither flank of that distance, from local circumstances, would a movement, however, be very likely, and from any point between, through a dense population, previously organized, and acting with additional forces on land and on the river, naval and artillery, the advance of a hostile force would not be altogether easy work.

Burrard Inlet is remarkably adapted by nature for secure defence against any force by sea. It is secure from land attacks from the north, and the formation of the whole neighborhood southwards to the frontier, and for many miles eastwards, is such that an approach from the frontier would, under defence, be found all the way a peculiarly troublesome matter by an enemy.

It is obvious a strong naval force will be indispensable in the defence of this portion of the Dominion, no matter what lines of railway may be constructed. That naval force will doubtless be supplemented by an armed local flotilla of varied construction and armament, thoroughly well commanded and directed for the more immediate defence of the whole of the straits, and also for service on the Fraser River up to the highest navigable point.

This complete naval force will, doubtless, be used not alone for defence, but also for attack, so as not to yield the command of the straits. It will doubtless, also, where needed, give convoy to important local commerce in and through the straits.

The naval authorities will, no doubt, also move all concerned to be early alive to the importance of early local formation of naval volunteers, and we may feel assured that as in the rest of the Dominion, so here, all best adapted precautions, military and naval, will be taken to meet the contingencies of war.

It is evident that if a foreign power holds the commanding naval power in this region that not only will the lines of approaches all through the straits from end to end, north to south, Bute Inlet and Burrard Inlet, be hazardous, but also the sixty or seventy miles of approach from outer ocean to Esquimault included. For the Straits of Fuca would be equally, doubtless more especially, offensively occupied, and so also would be the approaches to the outside harbors of Vancouver Island.

If, on the other hand, the commanding naval power be with us, it would probably not be long before the straits be in a position to be kept clear from any hazard afloat to vessels conveyed through to their destination.

The armed flotilla on the Fraser, with local land forces, may be expected also to keep a good account of their charge.

The condition, in short, of this part of the Dominion and its communications would be equally liable to risk with other more important and equally vulnerable portions of it elsewhere, and be equally called upon to meet the exigencies and endure the injuries of a temporary state of conflict.

The value at which in this particular question to estimate such risks and possible injury under a contingency that may never occur, compared with all other solid and progressive advantages, cannot be taken as so great as to supersede the latter.

Connected with this part of the whole subject it is well to urge the importance as a Dominion and as an Imperial consideration that this district along both sides of the Fraser, and also along the east coast of Vancouver Island (especially between Esquimault and Nanaimo), and also the islands in the straits should be settled up in the fullest manner as early as possible.

The best encouragement would be the liberal formation of roads and establishment of villages or small towns.

Both roads and villages, as far as practicable, in unison with general roads, to have strategical principles in view. Such roads, and well placed sites, in a fully populated district, would be among the very best of defensive works, and to effect this early is worthy of the serious consideration of the Dominion Government.

In these notes I have made no allusion to New Westminster, on the Fraser, as a terminus. It is to be presumed that it has been considered and rejected on grounds that appear to be sufficient. In another paper a few observations on this point may, however, not be inacceptable.

(Signed) R. C. MOODY.

30th September, 1878.

## APPENDIX No. 11.

### NOTES ON AN EXAMINATION OF THE HARBOURS AND NORTHERN COAST OF BRITISH COLUMBIA, BY CAPTAIN J. C. BRUNDIGE, DATED PORT SIMPSON, 12TH MARCH, 1880.

Captain Brundige, in accordance with the letter of instruction from the Engineer-in-Chief, sailed from Victoria on 27th June, 1879, for the northern coast of British Columbia, arrived off the mouth of the Skeena on the 13th July, and proceeded at once to make careful examination of the several harbors and coast line of the northern portion of the Province, with the several approaches from sea, embracing a thorough examination of the Dixon Entrance to the north of Queen Charlotte's Islands, and also the approach from the Pacific, southward of this group.

Captain Brundige prosecuted his surveys of the outer approaches until November, when the weather became too wintry for their further continuance, since which time, and up to date of his report, 12th March, 1880, he has been engaged in making further soundings in Port Simpson, tidal measurements and full weather observations for the months of November, December, January, February and the first part of March, the tables of which, also published herewith, are of great interest as showing the character of the winter months on the northern coast of British Columbia. The following notes are condensed from his report:—

### PORT ESSINGTON.

Port Essington is situated on the River Skeena, about eleven miles from the mouth. Here there is a large basin about 4 miles long and 2 wide, from 4 to 7 fathoms water, with muddy bottom. Tide runs out from 5 to 6 knots per hour, and up from 3 to 4 knots. The spring tides rise and fall 20 feet, and the neap 15 feet.

A heavy cross-sea is caused by strong winds from N.W. to S.E., and vessels riding at anchor in the current here during a gale of wind. would be sure to foul and trip their anchors.

I ascertained from several traders and others, who had been in this locality for many years, that during the months of December, January, February, and even into April, heavy masses of ice with large trees drift up and down with the tide, which would render this port useless during the winter, and also cause destruction to any wharves that might be constructed.

### APPROACHES FROM SEA TO PORT ESSINGTON.

The entrance to the Skeena below Port Essington, is divided into three channels by McGrath and Kennedy Islands. They are designated North, Middle and Telegraph channels.

North Channel is narrow, not being more than three cables in width, several sunken rocks, two and a-half fathoms water, and very swift current, only suitable for small vessels.

Middle Channel is also dangerous, being in some places very narrow and abounding with sand banks, which shift at times. Soundings gave three to four fathoms, and in some spots, eight fathoms.

Steamers coming from the north; often take this channel in order to touch at Port Essington on their voyage.

Telegraph Channel is the main channel. Did not find less than six fathoms of water, with a current of from two to three knots per hour. There is very good anchorage in 10 to 20 fathoms water in Cardina Bay, at the south end of Kennedy Island, sheltered from west round to north and east, but exposed to the south and south-west winds.

### PORT FLEMING.

Between Kennedy Island and Grenville Channel, distance six miles, there are three islands, Marack, Bedford and Gibson, and between these islands and the mainland there is a good harbor of even soundings from three to seven fathoms, with muddy bottom and very little current, as the tides meet here and form still water. This basin I have named Port Fleming, it is sheltered from all winds except the north, which could not create any sea, owing to the tide setting out through the different channels. Port Fleming would accomodate a large number of ships in safety, and there would be no difficulty in building wharves, as the water close to the shore is from three to four fathoms deep.

On asking masters of steamers the reason they did not anchor in this place, their reply was, that they always thought the water shoal, and thatit was out of the track for vessels bound north, as they came through Grenville Channel and kept Gibson Island on their starboard hand.

Captain Madden, an old trader and pilot, stated that he always found this harbor good, well sheltered from wind, and free from currents and sea, and considered it the best between Port Simpson and Vancouver's Island for large or small ships.

This is the only place that I could recommend for a terminus of the Canadian Pacific Railway nearer the mouth of the Skeena River than Port Simpson. I consider there would be no difficulty in bringing the railway down past Essington. The land presents a good site for a town, as it rises gradually back for some distance.

### APPROACHES TO PORT FLEMING.

I made a careful examination of the approaches from the sea to Port Fleming. The first examined was Ogden Channel, which I found to be good and with very little current, only one knot per hour, as the main current runs through Arthur and Malacca Passages. The entrance to Ogden Channel is divided into two channels by Spicer Island, which are named respectively Beaver and Schooner Passages, the former of which is the best, it is about one mile wide, from 40 to 50 fathoms deep and free from rocks and shoals. With a light on White Rocks (northern point of Banks Island) and a beacon light on Tree Island, ships could enter the channel in all weathers. Schooner Passage is also very good; it is narrow, with a cluster of small islands, all above water, at its entrance.

I consider that there is not a better locality for ships to make the land on the whole coast than here. There is a small island outside, named Bonila, which is a remarkably conspicuous object, being dome peaked and unlike any other on this coast, and may be seen for 20 or 30 miles at sea.

There are other reasons for recommending ship-masters coming from the south to make this point, viz.: there being no inlets for fifty miles, the tide sets regularly along the coast; there is deep water of from 60 to 70 fathoms, and as soon as abreast of Bonila Island, about 35 fathoms, off White Rocks 70 fathoms, and a few miles further 40 fathoms. This is named Browning Entrance on Pender's chart.

Ships could sail in or out of Port Fleming with a good commanding breeze, the distance being only 18 to 20 miles.

The temperature of the climate was found to be very even during a 15 days (latter part of July) sojourn in this locality. Mean of thermometer from 54° to 58°; no rain, excepting a shower for an hour or two, the weather being clear and free from fog.

The approach to Port Fleming from the north is by Arthur Passage, which opens into Chatham Sound. It is about two miles wide, with a current of two knots per hour. Good anchorage was found on west side of Smith's Island, opposite Mount McGrath.

### METLAH CATLAH.

Metlah Catlah is only fit for small vessels, as it is very narrow inside. Steamers of any size are obliged to remain some distance outside.

### DUNCAN AND BIG BAY.

Duncan Bay is an open roadstead with fair anchorage; it is sheltered from the east round to south, but open to south-west round to north-west. At north entrance to this bay Hodgson's Reef extends off shore two miles. Foul ground was found all along this coast for six miles to the entrance to Big Bay, at the head of which there was good anchorage in from four to ten fathoms, and fairly sheltered; the entrance, however, is not good, there being foul ground and sunken rocks all across the mouth.

Ship-masters, unless well acquainted with it, should not attempt the entrance.

### PORT SIMPSON.

Port Simpson is the most northern harbor of British Columbia, and is situated in latitude 54° 34′ N., longitude 130° 25′ W. It embraces over four square miles of water, from four to twenty fathoms deep with muddy bottom and good holding ground, and free from rocks and shoals. It possesses great facilities for dockage, as the four-fathom water is found close to the banks. It is easy of access from sea, having no current tide, but merely rise and fall, well sheltered from all winds except from the west, which here seldom blows. The prevailing winds are south-west and north-west, from the effects of which the harbor is so well protected that a little dingy boat can be rowed over it with safety in all seasons of the year. Ships could lie along side of docks at all times, and would require no towage either in entering or going to sea.

From accurate measurements made through a period of three months the rise and fall of the tides was found to be as follows: Spring tides 23 feet and neap from 15 to 16 feet, very regular and scarcely influenced by winds.

During a residence of four months in the locality of Port Simpson and Chatham Sound, I did not experience six hours of fog, and during that period there were only four parts of days and nights in which it would have been impossible to see to navigate vessels into port. I have no hesitation in saying that it is one of the best harbors I was ever in.

### APPROACHES TO PORT SIMPSON.

I made a careful examination of the approaches from sea to Port Simpson. About four miles off the harbor, there is a reef of rocks called the Pointers, about 30 feet above water, with no foul ground, 60 fathoms was the least depth found around them. I then proceeded out through Dixon Entrance, but night coming on put into a small harbor at the north end of Dundas Island. It was stated that there was no anchorage here, but I found a small river which extended into the island for five miles or more, where I remained all night, and the next morning put to sea. At the north end of Dundas Island, there are seven small islands named Gnarled Islands, and reported to have foul ground, but this was found incorrect, as soundings shewed not less than 45 fathoms close to them all around.

To the west of Dundas Island is a small one named "Zayas," about 3½ miles long and two miles broad; there is a good channel between Dundas and this island, which steamers bound to Queen Charlotte's Islands frequently take. He then proceeded south along Dundas Island to Brown Passage, sounded and found nothing but some small islands between Dundas and Middle Dundas Islands, then stood over to Rose Spit, and sighted it, but wind fell calm; the next day ran for Brown Passage and got soundings all across here from 20 to 50 fathoms.

I made a careful examination of Brown Passage, and found in the centre two rocks, (Hammer Rocks), just above water; they lie in the line of the passage, with not less than 15 fathoms close alongside of them.

About three miles south of these rocks is a small island called Osborne, from which a reef runs west by north for about one mile, named North Breaker. South of this are the Butterworth Rocks, which I consider a dangerous reef, situated four miles W.S.W. of Tree-nob Island; these rocks are above water and a light could be erected on them. Two and half miles north by compass from Centre or Hammer Rocks lay Simpson Rocks.

The above describes all the dangers of Brown Passage, the water is deep, with a current of about 1½ knots per hour.

Ships can enter this passage and sail direct to Port Simpson, or by Arthur Passage to Port Fleming.

Chatham Sound has very little current as far as the Pointers, to the north of Port Simpson, not more than one knot, and ships will not require towage to Port Simpson, and not even a pilot if they have a good chart.

A strong current sets out of Nasse and Wark Channels into Chatham Sound and sweeps past the Pointers and then flows out through Dixon Entrance, between Dundas Island and Alaska. The current is about 2½ knots per hour.

I examined Rose Spit and found a strong current of about two knots; this spit or sand bank extends out about four or five miles, with boulders and timber or large trees buried in the sand. Soundings were found to be gradual from 40 fathoms down to five fathoms close alongside; also, good even soundings all the way to Masset with sandy bottom. Ships could anchor under Cape Rose with S.E. gale in five to eight fathoms.

Masset is a bar harbor with not less than five fathoms, and is easy to approach; is about 50 miles west of Rose Point on the north of Queen Charlotte's Islands. I found good soundings all along the coast, and having head wind, sounded off and on; had 30 fathoms about eight miles from shore, when the lead dropped into deep water. This whole coast is free from rocks with a beautiful sand beach, and the current is not more than 1½ knots.

Proceeding west, I then passed Virago Sound, and at a point half way to Cape North got bottom in 65 fathoms at about four miles from shore.

Ships can approach close to North Island or Cape; I found 30 fathoms close in shore and got bottom some miles off in 160 fathoms.

I then sailed for Cape Muzon in Alaska. This is a barren bluff point, with deep water close to it. Landing at this Cape I had a good observation, which gave a latitude 54° 42′ 15″ north and longitude 132° 40′ 30″ west, I found the current here to be about one knot per hour, and think it is a little more at North Point. Cape Muzon may be easily known from sea, it is a long sharp bluff with four small islands on its north-east side.

I then sailed for Cape de Chacon, and found it a dangerous point; reefs of rock extend out three or four miles, on which the sea breaks heavily. Was unable to obtain an observation as the weather was cloudy. The mariner should not approach this cape within five miles, unless the weather is clear.

In Dixon entrance the temperature of the water was found to be off Rose Spit 50°, and off North Cape 54°. Mean of climate from the 14th July to 24th August, 58°, lowest 54°, and highest 63°. The above readings of the thermometer were in the shade, and from the 27th June to the 24th August, I experienced only fourparts of days of rain and a little fog, the wind light and variable, this is the most even climate I was ever in.

On returning to Port Simpson, I sent the sloop back to Victoria, she having become leaky and unseaworthy. I then procured a canoe with a crew of

Indians, and returned to the Dixon entrance to search for the Devil's Ridge I found a sunken rock about four mile north-westerly of Zayas Island having only six feet of water over it at low water; it is about 20 feet cross, and appeared to be round; got 10 fathoms at about 15 from it, and obtain from 10 to 17 fathoms, and then dropped into deep water with no bottom at 160 fathoms. As near as I could judge, the reef is not more than one acre; the soundings were obtained on the south-west side, but on the north-east side I ran the nose of the canoe close to the breakers and could find no bottom at 160 fathoms; it is evidently straight up and down. The tide here sets south-west and north-east, not more than one knot per hour. With a good bell buoy anchored close to this rock ships could sail in safety. I obtained several good observations, and found it to be in latitude 54°, 40' 45" north and longitude 131°, 08' 15" west, with the following bearings: Cape de Chacon, bore S.W. by W.; Gnarled Island, E. by N.½ N.; Zayas Island, S.S.E.½ E., all magnetic. I have no doubt of this being the Devil's Ridge. I was told by several Hydas chiefs, who had been crossing here all their lives, and their fathers before them, that there is no other rock or reef in this locality, and they directed me to go where I found the above rock.

The Indians also informed me that I would find one big stone between Capes de Chacon and Northumberland. On showing them the chart on which this rock was marked, they replied, no stone there, but further in. So having camped on Zayas Island, I put out to look for these rocks in the position marked on the chart, but after a diligent search, was unable to find them. It being calm, we lay to all night in the canoe, much against the Indians' wish, who feared they would be all lost, and in the morning, 29th August, continued on toward Cape de Chacon, but saw nothing. We then steered for the place indicated by the Indians, it being cloudy but clear; I soon saw something that looked like breakers; the wind was now blowing strong from S.W., and as I neared, saw the sea breaking heavily at a distance of about two miles off. It being low water, I approached as near as possible, and took the following bearings: Cape de Chacon, S.W. by W.; island off Cape Northumberland, E. by N.½ N.; small island on west side of Clarence Straits, N. W.½ W. The above bearings place this reef eight miles true north of where it is placed on the chart, marked position doubtful. The breakers appeared to cover a space fully one mile in extent.

### WARK INLET.

I again returned to Port Simpson, where I was told that there was a rock a few miles up in the centre of Wark Inlet. I proceeded out and found it just visible at very low tide. This is described as a wonderful rock, very small at top, and 130 fathoms water close to it. The lead went down thump, thump, until 130 fathoms were run out, but no bottom found. I paddled all around it with the line out. This rock is situated abreast of Mount McNeal, and the point that leads into the bay opposite Port Simpson.

I ran a line across from Wark Inlet to Port Simpson Harbour, at the lowest part of the Peninsula, course was S 50° W. 4,500 feet distant from water to water, summit about 60 feet. I cannot see any difficulty in bringing a line down the south side of Wark Inlet and then across to Port Simpson at the above place.

Wark Inlet is quite narrow at the entrance, and only 32 fathoms deep. Entering about a mile the water deepens to 160, and above that all the way up, there is no anchorage in any part of it, except the little bay opposite Port Simpson, where I ran line across.

### QUEEN CHARLOTTE'S ISLANDS.

I considered that my work would not be completed unless I examined the entrance to the south of Cape St. James, at the southern extremity of Queen Charlotte's Islands. I therefore obtained the services of a good pilot, Mr.

Madden, of Port Essington, and fitted out a canoe with an Indian crew and one month's provisions, and left Port Simpson on the 25th September for Queen Charlotte's Islands. Was obliged to put into Metlah Catlah, where I was detained by contrary winds and rain until 30th September, when I made Eddy Passage and camped on Prescott Island. I was again detained until the 5th October by a strong gale from the south. During my detention I examined the Eddy Passage, and found it more than a mile in width and five miles long, a good safe channel, free from rocks, with water from 20 to 50 fathoms, and very little current. On the 6th October, I put out and made Queen Charlotte's Islands, at Skidigate Harbour, about 60 miles south from Rose Spit. Thence running along the coast at about two miles from shore, obtained soundings at intervals of from five to eight fathoms; the land is low for some distance back, with a beautiful sandy beach for a distance of 25 miles to Cumshawa Harbour. I continued my voyage to Cape St. James, and examined the coast very fully. It is fringed with islands affording many places of shelter for vessels, the interior being high rolling mountains covered with timber.

11th October—Mean of thermometer, 48°

13th October—Mean of thermometer, 51°, and water off coast 54°.

On the 15th October, I made Cape St. James, at the south end of Queen Charlotte's Islands, and ascended the cliff, which was about 100 feet in height. The weather being clear, had an extended view from north to east, south and west, and could not observe any breakers. There are four small islands off the Cape from 100 to 150 feet high, of which I made a careful survey, and found the outer island to be in latitude 51° 52'.04" north. I sounded on the south-west side of these, keeping about four cables off, and got from 40 to 70 fathoms. I experienced great difficulty in returning from these islands to the Cape, and was in great danger of being swept out to sea, the wind blowing off shore, and the tide having turned and setting south-west at fully three knots per hour.

(Captain Brundige gives in his report a very minute and valuable description of the east coast of Queen Charlotte's Islands, but it is too voluminous for insertion in this place.)

From Cape St. James I returned up the same coast, and crossed over to Port Simpson, where I arrived on the 22nd October, having been given up as lost by every one there, as this October had been the most boisterous experienced for many years. I found very little change in the temperature of the water from July to the end of October, not more than a degree or two, the mean being 56°.

### PORT SIMPSON.

After having made a thorough examination of Port Simpson and its approaches from the Pacific Ocean, I may say there are few harbors in the United Kingdom of Great Britain and Ireland to equal it.

It is easy of access, by the Dixon Channel, which is ten miles in width at the narrowest part. I consider this entrnnce free from danger, with the exception of the Devil's Ridge, previously described, which only requires a bell buoy to guide the mariner.

I would rather run through Dixon Entrance to Port Simpson on a dark night, as it is, than the North Channel through the Mull of Cantire and its currents, or St. George's Channel from the Tuskar Light to the Mull of Galway, with all the lights and fog signals, and I fail to see on what grounds the Naval officers founded the views set forth in their report, namely, "That Rose Spit would always be a large element of danger in using this channel."

The Spit in question is well defined, but, of course, as with the beach or rocks on any shore, is not the proper position for any vessel. No ship-master who knows his duty would run his vessel on the shoal water at the Spit, when there exists a channel twenty-four miles wide, free from shoals or other dangers, in which the tide is regular ebb and flow.

Ships coming from the south and west can make Cape St. James in safety, just as ships make Cape Clear on entering St. George's or Bristol Channel.

They will have a good landmark, free from all danger, and a beautiful strait to sail up in good soundings, 25, 40 and 70 fathoms. As they sail up they can enter Ogden, Eddy or Brown's Passages, either of which is superior to San Juan, having very little current and no fog, the currents being the regular ebb and flow.

I believe if this coast was properly surveyed, soundings would be found to the west of Queen Charlotte's Islands to guide the mariner in approaching the land, as I see the Naval officers of the United States report finding a bank to the west of Prince of Wales' Island, Alaska, on which they caught some fine codfish. This bank is just to the north of Graham Island, and I have no doubt that it extends south.

This whole coast requires to be surveyed and re charted, as none of the charts are correct. It would not be much expense, with the present information, to have them corrected. I feel certain that Queen Charlotte's Islands are placed some miles too far east, as I have taken several lunar observations, and find from ten to twelve miles out in different places. The latitude of Cape St. James is correct, as is also Port Simpson.

## *Notes on the Climate and Productions of the country.*

### CLIMATE.

I was reliably informed at Port Essington that the months of June, July and August are the finest; that in September, October and November there is a considerable amount of rain, cloudy and strong winds, but with very little fog, similar to the north-west coast of Ireland.

During December, January and February, strong gales, cold and frost, rain and snow, the latter falling sometimes to a depth of two feet, but does not remain long on the ground. It is unusual for the thermometer to fall below zero.

March, April and May comprise the principal rainy season at Port Essington, but, strange to say, the climate varies very much, for ten to fifteen miles off it is quite different.

I again visited the Skeena during the latter part of December, and found large quantities of ice drifting up and down the river. Ships could not remain at Port Essington during the months of December, January, February and March and well into April. The north channel of the Skeena is blocked full of ice nearly all winter, but it seldom reaches down as far as Kennedy Islands. Port Fleming is free from ice.

I also visited Essington during the month of February for several days, and found large quantities of ice in and around it. The snow-fall here has been about 6 feet on the level. I measured the snow at several places and found 3 feet at Port Fleming, and 1½ feet at Inverness.

I herewith enclose weather table. It is to be regretted that the winter I have passed here has not been nearer an average season, as the record of it may deceive many.

This has been the most severe winter ever known here. The severity of the weather has, according to the opinions of residents of 20 years' standing, never been equalled.

The average winter here is moist, and just as free from fog as this one has been, with north and south-east winds. Ten degrees of frost is considered a very low temperature. So entirely were the residents unprepared for such unprecedented weather, that all the vegetables have been frozen, as none of the cellars were constructed to guard against a temperature with the thermometer at zero.

The snow-fall (at Port Simpson), although not very great, has continued on the ground longer than known before.

Mr. Hall, of the Hudson Bay Company, for instance, records the budding of trees at Port Simpson on the 10th February, 1878, and at that time flowers were in bloom in his garden.

The extremely severe weather of the present winter has been by no means local, as by accounts received from the north and south of us, as well as from the interior, such weather has never been known.

The snow-fall at Port Simpson during this winter did not exceed 28 inches altogether, and from information gathered respecting other winters the average maximum is not greater than 18 inches, and it never remains more than a day or two.

The mean temperature of the water in the harbour was 34° during December, January and February; it never fell to freezing point throughout these months.

During all this seven months the highest sea in the harbour was 9 inches, at the tide pole, which is placed at the most exposed part of the harbour.

### WINDS.

The prevailing winds throughout the year are from the south-east and north. I see by Admiral Richard's coast pilot directions in and around Vancouver Island, that south-east gales are from 12 to 72 hours' duration, and north and north-west much longer.

I have now been eight months on this coast and have closely observed the winds, and can state that there has been during that period only one strong gale, and that was on the 17th October, and from the south-west. I find that south-east gales last from 4 to 12 hours, they then vere round to south-west with heavy squalls for a few hours and then calm.

### PORT ESSINGTON.

The soil around Port Essington is of very limited extent, consisting only of a few garden patches in which potatoes grow very well; the land can not be utilized to any extent, as there is such a quantity of turf and moss which causes the soil to be damp.

There is a large quantity of spruce, hemlock, red cedar and yellow cedar or cypress. The spruce grows to a great size and length, frequently 3, 4 and 5 feet in diameter, and from 100 to 150 feet in height. The yellow cedar is a fine quality of wood, and valuable for ship-building, as it is very durable; it also makes beautiful furniture.

### METLAH CATLAH.

An Indian village and mission.

The houses are built in a civilized style, and there is a fine large Church with School-house and Mission-house.

Messrs. Duncan and Colison are stationed here; the former has been in the country for many years, and is the founder of the Mission. The land around this village seems more suitable for cultivation. and the Indians have numerous gardens in which they raise sufficient potatoes and vegetables for their own use.

At Big Bay there is a fine saw-mill, owned by Mr. George Williscroft, who supplies the country around with lumber, and also ships it to Victoria.

### PORT SIMPSON.

This is one of the oldest Hudson Bay stations on this coast, and the company have here a large trading store.

The land suitable for cultivation is very limited. The Indians have garden plots in which they raise some fine potatoes, turnips and other vegetables. The Hudson Bay Company cultivate several acres and raise large quantities of garden products.

The timber is plentiful, comprising red cedar, spruce, hemlock, alder and cypress. The spruce and red cedar are of good quality, and grow to a great size.

### QUEEN CHARLOTTE'S ISLANDS.

Masset is situated on the northern side of Graham Island. Here there is an Indian village and Hudson Bay post. Mr. McKenzie, the officer in charge, received me very kindly, and gave me much information of the country. I went into the woods and saw some very fine spruce, cedar, hemlock and a little birch.

The soil was rich, level and free from stone, and in many places considerable patches of prairie. I saw some timothy-grass growing wild, which stood four feet high, with heads seven inches long. The Hudson Bay Company have here a number of fine cattle, as fat as seals; they run at large, and are not looked after and not housed during winter. Snow very seldom falls, and only remains on the ground for a day or two.

Mr. McKenzie, who is from Scotland, says he is confident that wheat, oats, barley, potatoes and hay can be raised here equal to any grown in Scotland.

Skedigate is about 60 miles south of Rose Spit.

The Indians here grow some fine potatoes and turnips, but they do not care to till the soil, as they live principally on salmon and fish eggs.

I was told that there is plenty of red cedar, spruce, hemlock and beautiful cypress in large quantities. These trees are abundant at several points visited on the Islands.

At Spit Point, off Skedigate, the Indians have raised potatoes and turnips of excellent quality.

Here I found the prettiest grove of spruce timber I ever saw for mast pieces and yards, in fact, they look like the red pine on the Island of Corsica. The land is low, and along the beach the grass grows very tall. I saw what looked like plains in the distance as I sailed along the coast.

This Group consists of three principal islands—Graham, Moresby, and Prevost, the former being the most northern and contains the largest area of land suitable for agriculture; grass is in abundance. I have no hesitation in stating that nearly all kinds of grain, vegetables, and the hardier fruits will grow well.

This part of the Island compares favorably with the County Donegal in the north-west of Ireland, having seldom any snow or frost and no fog, but perhaps a little more rain during the winter months.

There is a considerable area of good land on the east side of Moresby Island, from Skedigate to Cumshewa.

The islands are well timbered with red cedar, spruce, cypress, hemlock and alder. On the west side there are large tracts of land producing nothing but pine and large cypress.

I am informed that coal is found in different parts, and of excellent quality. Copper and gold have also been discovered.

### FISH.

The northern coast of British Columbia, embracing Queen Charlotte's Islands, abounds with fish; salmon, halibut, cod, dogfish, herring, whiting and colachen Of the above the salmon is the only kind which at present is utilized to any extent, and this business has only sprung into importance during the last few years; salmon curing and canning being now one of the principal industries of this Province.

The salmon are of superior quality, and most abundant.

Halibut is also very abundant, but never caught except for home consumption. This fish is of excellent flavor and attains a great size. The Indians catch large quantities and dry them for winter food, I am informed that cod of excellent flavor is found in these waters, but I am not aware that any attention has been given to search out its haunts; doubtless banks will be found off this coast, where these fish will be caught in abundance.

A bank is reported by United States naval officers to have been found to the west of Prince of Wales Island, Alaska, on which some fine cod were caught.

The herring is found at certain seasons of the year along the whole coast in myriads. The herring of these waters is a little smaller than that on the Nova Scotian coast, but is otherwise of similar quality.

The spawn of the herring deposited on the rocks and kelp is collected in enormous quantities and forms one of the staple articles of Indian food.

The oolachen is caught during the spring in many of the streams, but nothing is definitely known of its haunts or habits, except that it appears suddenly at the mouths of several rivers, ascends a short distance, but not above tide-water, spawns and disappears. While in the rivers spawning, that is for about three weeks, the oolachen can be caught in seines or scooped into boats. This fish is in great request, its delicacy of flavor being equal to the sardine, and its nutritious and wholesome qualities are undoubted. It has not as yet been introduced into any foreign markets.

At Woodcock's Landing and at Cardena Bay there are salmon-canning establishments, and at Skedigate on the east coast of Queen Charlotte's Islands there is a company established for making oil from the dogfish, which produces a beautifully pure and clear oil.

Port Simpson Weather Table, by Captain Brundige, November, 1879.

| Day. | Winds. | | | Thermometer. | | | Hours of rain. | Hours of snow. | Hours of sun-shine. | Hours of cloud. | General Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Morning | Noon. | Evening | Highest. | Lowest. | Mean. | | | | | |
| | | | | ° | ° | ° | | | | | |
| Saturday, 1st .... | Calm. | Calm. | Calm. | 48 | 44 | 46 | ...... ...... | ...... | All day. | ...... ...... | Very pleasant day throughout. |
| Sunday, 2nd..... | S. | S. | S. | 48 | 44 | 45 | ...... ...... | ...... | " | ...... ...... | do do only a light breeze from the south blowing. |
| Monday, 3rd...... | S.E. | S.E. | S E. | 48 | 44 | 46 | ...... ...... | ...... | " | ...... ...... | do do breeze very light throughout the 24 hours. |
| Tuesday, 4th...... | N.E. | E. | E. | 46 | 42 | 44 | 5 | ...... | 3 | 2 | Wind a nice breeze in the forenoon; a strong gale in afternoon from east. |
| Wednesday, 5th.. | W. | N. | N. | 47 | 43 | 45 | ...... ...... | ...... | All day. | ...... ... | No wind, only light variable airs and pleasant. |
| Thursday, 6th.... | S.E. | S.E. | S. | 48 | 46 | 47 | 4 | ...... | ...... ...... | All day. | Forenoon fine; afternoon drizzling rain; towards evening clear and fine. |
| Friday, 7th....... | S.E. | S.E. | S.E. | 48 | 44 | 45 | 2 | ...... | ...... ...... | " | Light breeze up to 6 p.m., when it blew strong breeze till 10 p.m., then light |
| Saturday, 8th..... | Calm. | Calm. | Calm. | 49 | 46 | 47 | ...... ...... | .. | ...... ...... | " | Nice mild day throughout. |
| Sunday, 9th...... | S.E. | S E. | S.E. | 50 | 46 | 49 | 5 | ...... | ...... ...... | " | Light wind from S.E., with occasional showers. |
| Monday, 10th .... | S.E. | S.E. | S.W. | 48 | 44 | 45 | ...... ...... | ...... | ...... ...... | " | Light airs in forepart; afternoon, light air from S.W. |
| Tuesday, 11th.... | N. | N.E. | N.E. | 48 | 43 | 46 | ...... ...... | .. | All day. | ...... ...... | A beautiful day with light breeze. |
| Wednesday, 12th | N.E. | " | " | 49 | 45 | 47 | ...... ...... | ...... | " | ...... ...... | do do |
| Thursday, 13th... | S.E. | S.E. | S.E. | 48 | 44 | 46 | All day. | ...... | ...... ...... | All day. | Strong breeze up to noon, when it strengthened into a strong gale; at 10 p.m. light. |
| Friday, 14th...... | " | " | " | 47 | 43 | 45 | Showers | ...... | 2 | 7 | Strong breeze up to noon; afternoon squally till 7 p.m.; more moderate. |
| Saturday, 15th... | " | " | " | 49 | 45 | 47 | 3 | ...... | 6 | 3 | Moderate wind with passing showers, sunshine at times. |
| Sunday, 16th...... | " | " | " | 48 | 44 | 46 | 4 | ...... | 5 | 4 | do do do |
| Monday, 17th..... | " | " | " | 50 | 48 | 49 | All day. | ...... | ...... ...... | All day. | Strong breeze with heavy rain all day. |
| Tuesday, 18th.... | N.E. | N.E. | N.E. | 50 | 48 | 49 | ...... ...... | ...... | All day. | ...... ...... | Clear and fine with light breeze. |
| Wednesday, 19th | E. | Calm. | Calm. | 52 | 50 | 51 | ...... ...... | ...... | " | ...... ...... | Beautiful day, almost calm. |
| Thursday, 20th... | Calm. | Calm. | S. | 51 | 48 | 50 | ...... ...... | ...... | " | ...... ...... | do do |
| Friday, 21st...... | S. | S. | S. | 50 | 49 | 50 | ...... ...... | ...... | " | ...... ...... | do do |
| Saturday, 22nd.. | Calm. | Calm. | Calm. | " | " | " | 2 | ...... | 7 | 2 | A low fog hung over the harbor for about four hours. |
| Sunday, 23rd...... | S.E. | S E. | S.E. | 50 | 48 | 50 | 3 | ...... | 6 | 3 | Beautiful day after 10 a.m. |
| Monday, 24th..... | " | S. | S. | 50 | 48 | 49 | 2 | ...... | ...... ...... | 9 | A fine cloudy day and nearly calm. |
| Tuesday, 25th..... | S.S.W | S.W. | S.W. | 50 | 48 | 48 | 2 | ...... | ...... ...... | All day. | A little fog in the morning; at noon, fine; hazy in the afternoon. |
| Wednesday, 26th | S.E. | S.E. | Calm. | 49 | 47 | 48 | 2 | ...... | ...... ...... | " | Strong breeze in the morning; moderate in afternoon; calm at night. |
| Thursday, 27th... | Calm. | S.E. | S E. | 48 | 44 | 46 | 2 | ...... | ...... ...... | " | Morning calm; noon, light air from S.E.; at 4 p.m. showers of rain. |
| Friday, 28th .... | " | S.E. | S.E. | 40 | 32 | 35 | 4 | ...... | ...... ...... | " | Morning calm with slight frost; midnight, very heavy rain. |
| Saturday 29th... | N. | N. | N. | 40 | 28 | 33 | ...... ...... | ...... | All day. | ...... ...... | Light breeze, with slight frost, morning and evening. |
| Sunday, 30th ..... | " | " | " | 34 | 26 | 32 | ...... ...... | ...... | " | ...... ...... | Strong breeze from the north, clear and cold all day. |

### Port Simpson Weather Table, by Captain Brundige, December, 1879.

| Day. | Winds. | | | Thermometer. | | | Hours of rain. | Hours of snow. | Hours of sunshine. | Hours of cloud. | General Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Morning | Noon. | Evening | Highest. | Lowest. | Means. | | | | | |
| | | | | ° | ° | ° | | | | | |
| Monday, 1st | W. | W. | W. | 34 | 20 | 25 | | 8 | | All day. | Strong breeze; commenced to snow at 8 a.m.; at night. moderate and clear. |
| Tuesday, 2nd | " | " | N. | 37 | 25 | 32 | | | | " | Light breeze; eight inches of snow fell last night; clear this evening. |
| Wednesday, 3rd. | Calm. | Calm. | S. | 40 | 35 | 37 | 2 | | | " | Calm and fine; commenced to rain at 10 a.m.; afternoon clear. |
| Thursday, 4th | N. | N. | W. | 39 | 37 | 38 | | | All day. | | Very light air, snow nearly all gone; a little rain at midnight. |
| Friday, 5th | Calm. | Calm. | S. E. | 40 | 34 | 36 | | | 4 | Half day | Forenoon, fine and clear; noon, cloudy; no rain at 8 p.m.; clear. |
| Saturday, 6th | S. E. | S. E. | S. E. | 30 | 23 | 27 | | | | All day. | An uncommon event on this coast, frost with S.E. wind. |
| Sunday, 7th | N. | N. | N. | 30 | 21 | 24 | | | All day. | | Bright and cloudless all day, with stiff breeze. |
| Monday, 8th | N.E. | N.E. | N.E. | 25 | 28 | 21 | | | " | | do do strong breeze throughout the 24 hours. |
| Tuesday, 9th | E. | E. | E. | 37 | 32 | 34 | | | " | | Passing bright clouds, very nice weather. |
| Wednesday, 10th | N. | N. | N. | 36 | 25 | 33 | | | " | | Moderate breeze, very nice weather. |
| Thursday, 11th | W. | W. | W. | 40 | 28 | 32 | 4 | 2 | | All day. | Moderate weather; afternoon, drizzing showers, late at night 1½ in. snow fell. |
| Friday, 12th | S.E. | S.E. | S.E. | 46 | 40 | 44 | | | 6 | 2 | Pleasant warm day, resembling a Nova Scotia spring day. |
| Saturday, 13th | " | " | " | 50 | 44 | 47 | 2 | | | All day. | do do air very clear, objects visible at a great distance. |
| Sunday, 14th | " | " | " | 51 | 45 | 47 | | | | " | do do do do do |
| Monday, 15th | Calm. | N. | N. | 49 | 44 | 46 | | | All day. | | Beautiful weather, moderate breeze throughout. |
| Tuesday, 16th | N. | N. | N. | 44 | 41 | 41 | | | " | | do do do |
| Wednesday, 17th | " | " | " | 37 | 28 | 30 | | | " | | do no snow on the ground; very pleasant. |
| Thursday, 18th | " | " | " | 37 | 27 | 3[illegible] | | | " | | Every day for a week it has been clear, and the evenings beautiful. |
| Friday, 19th | " | " | " | 36 | 18 | 32 | | | " | | Light winds and clear. |
| Saturday, 20th | " | " | " | 26 | 17 | 20 | | | " | | do do |
| Sunday, 21st | " | " | " | 28 | 18 | 23 | | | " | | do do and the evenings beautiful. |
| Monday, 22nd | Calm. | Calm. | Calm. | 31 | 23 | 27 | | | " | | Excellent weather; calm, just a little frost; no snow; perfectly clear sky. |
| Tuesday, 23rd | N.E. | N.E. | N.E. | 32 | 25 | 30 | | 2 | 6 | 3 | do light breeze, a little dust of snow. |
| Wednesday, 24th | N. | N. | N. | 32 | 28 | 29 | | | All day. | | Clear, not a cloud to be seen. |
| Thursday, 25th | Calm. | Calm. | Calm. | 35 | 31 | 33 | | 1 | | All day. | Cloudy all day, no wind; about 1 inch of snow fell. |
| Friday, 26th | " | " | " | 36 | 33 | 34 | All day. | | | " | A drizzling rain all day; can see for miles out; no fog. |
| Saturday, 27th | N. | N. | N. | 34 | 28 | 30 | | | All day. | | Beautiful day; pleasant; not cold; light breeze. |
| Sunday, 28th | " | " | " | 30 | 16 | 26 | | | " | | Fine and clear, strong breeze; the thermometer at 16° above zero this morning, the lowest this month. |
| Monday, 29th | " | " | " | 31 | 16 | 24 | | | " | | Fine and clear, strong breeze. |
| Tuesday, 30th | E. | E. | E. | 30 | 22 | 25 | | 3 | | All day. | Light breeze; about five inches of snow fell to-day. |
| Wednesday, 31st | S.E. | S.E. | S W. | 31 | 23 | 26 | | All. | | " | Squally, with snow all day; more fine at 10 p.m. and midnight. |

## PORT SIMPSON Weather Table, by Captain Brundige, January, 1880.

| Day. | Winds. | | | Thermometer. | | | Hours of rain. | Hours of snow. | Hours of sun-shine. | Hours of cloud. | General Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Morning | Noon. | Evening | Highest. | Lowest. | Mean. | | | | | |
| | | | | ° | ° | ° | | | | | |
| Thursday, 1st | N. | N. | N. | 29 | 25 | 27 | | | All day. | | Bright, clear cold day; moderate breeze throughout the 24 hours. |
| Friday, 2nd | “ | N.E. | N.E. | 31 | 27 | 29 | | | | All day. | Almost calm in the forenoon; shifting to eastward; at 8 p.m., calm. |
| Saturday, 3rd | N.E. | E. | E. | 36 | 26 | 32 | | All. | | “ | Morning, moderate breeze; at noon, strong breeze; at 4 p.m., a gale with snow, continued to 12 p.m. |
| Sunday, 4th | N. | N. | N. | 19 | 15 | 17 | | | All day. | | Light wind. The snow-fall of yesterday measured 8 inches. |
| Monday, 5th | “ | “ | “ | 16 | 8 | 11 | | | “ | | Light breeze all day; cold but clear pleasant weather. |
| Tuesday, 6th | “ | “ | “ | 5 | — 3 | — 1 | | | “ | | do do the coldest day experienced at Port Simpson since the year 1862. |
| Wednesday, 7th | “ | “ | “ | 10 | — 5 | 7 | | | “ | | Light breeze all day. |
| Thursday, 8th | “ | “ | “ | 15 | 8 | 12 | | | “ | | Fine and pleasant day; moderate breeze. |
| Friday, 9th | “ | “ | “ | 20 | 15 | 18 | | | “ | | Beautiful weather; light air from north. |
| Saturday, 10th | “ | “ | “ | 25 | 15 | 18 | | | “ | | do do do |
| Sunday, 11th | “ | “ | “ | 15 | 12 | 13 | | | “ | | do do strong breeze throughout these 24 hours. |
| Monday, 12th | “ | “ | N.E. | 18 | 16 | 17 | | | “ | | do do light breeze; at sundown, calm. |
| Tuesday, 13th | E. | E. | E. | 25 | 18 | 23 | | | | All day. | All appearance of a change of weather; light airs. |
| Wednesday, 14th | S.E. | S.E. | S.E. | 44 | 41 | 40 | All day. | | | “ | Very warm; strong breeze; snow disappearing fast. |
| Thursday, 15th | “ | S.W. | S.W. | 45 | 42 | 44 | 3 | | 5 | 4 | Snow nearly all gone; at noon wind veered to S.W., when it blew a strong breeze and at 6 p.m., only light breeze. |
| Friday, 16th | S.E. | S.E. | S.E. | 46 | 44 | 45 | 5 | | | All day. | Showery; no snow on the ground. |
| Saturday, 17th | N. | “ | Calm. | 40 | 30 | 37 | | 1 | 8 | 1 | A little frost last night; pleasant day; about ½-inch of snow fell at 10 p.m. |
| Sunday, 18th | S.E. | S.E. | S.E. | 34 | 32 | 33 | | ½ | | All day. | Fine, cloudy day; at noon a few flakes of soft snow fell; light airs all day. |
| Monday, 19th | “ | “ | “ | 42 | 40 | 41 | 2 | | | “ | do about noon a light drizzling rain do |
| Tuesday, 20th | “ | “ | “ | 46 | 43 | 44 | | | | “ | do no rain throughout these 24 hours. |
| Wednesday, 21st | “ | “ | S.W. | 50 | 47 | 48 | 3 | | 4 | 5 | Forenoon, strong breeze; afternoon, blew from S.W. with squall. |
| Thursday, 22nd | S.W. | S.W. | S.W. | 47 | 43 | 44 | | | All day. | | Morning, strong breeze; at noon, gale; at 4 p.m., moderate; at 8 p.m., calm. |
| Friday, 23rd | S.E. | S.E. | S.E. | 44 | 40 | 44 | | | | All day. | Squally in the afternoon. |
| Saturday, 24th | N. | N. | N. | 20 | 29 | 29 | | | All day. | | Very pleasant day; light breeze in forenoon; at 1 p.m., strong breeze; at 8 p.m., nearly calm. |
| Sunday, 25th | “ | “ | “ | 29 | 28 | 29 | | | “ | | Very pleasant day; moderate breeze throughout a little frost. |
| Monday, 26th | “ | “ | “ | 27 | 25 | 26 | | | “ | | do strong breeze; evening, moderate. |
| Tuesday, 27th | “ | “ | “ | 33 | 28 | 31 | | | 4 | 5 | do light breeze. |
| Wednesday, 28th | E. | Calm. | Calm. | 40 | 36 | 37 | | ½ | | All day. | Fell about 1 inch of snow; quite pleasant. |
| Thursday, 29th | S.E. | S.E. | S.E. | 47 | 35 | 37 | 2 | | | “ | do 2 inches do some time during last night. |
| Friday, 30th | “ | “ | “ | 45 | 43 | 44 | 6 | | | “ | Light showers in forenoon; noon, a little finer; towards evening, strong breeze |
| Saturday, 31st | “ | “ | “ | 48 | 47 | 47 | 2 | | | “ | Snow all gone; very warm winds; like a spring day. |

PORT SIMPSON Weather Table, by Captain [illegible] ndige, February, 1880.

| Day. | Winds. | | | Thermometer. | | | Hours of rain. | Hours of snow. | Hours of sunshine. | Hours of cloud. | General Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Morning | Noon. | Evening | Highest. | Lowest. | Mean. | | | | | |
| | | | | ° | ° | ° | | | | | |
| Sunday, 1st | Calm. | Calm. | E. | 46 | 44 | 45 | | | | All day | Moderate cloudy day. No snow on the ground. |
| Monday, 2nd | " | " | Calm. | 48 | 44 | 46 | | | | " | Very calm, with a little mist which could hardly be called a fog; can see several miles. |
| Tuesday, 3rd | " | S. | S. | 47 | 43 | 44 | 3 | | | " | Almost calm; a mist in the afternoon. |
| Wednesday, 4th | " | Calm. | Calm. | 46 | 45 | 45 | | | | " | Very calm weather; a little fog in the afternoon for two hours, |
| Thursday, 5th | " | " | " | 41 | 40 | 41 | | | | " | do do clear weather throughout the 24 hours. |
| Friday, 6th | N. | N. | N. | 41 | 38 | 40 | 2 | | 6 | 3 | Misty; showers in the morning for two hours; latter part fine sunshine and clear. |
| Saturday, 7th | " | Calm. | Calm. | 40 | 38 | 30 | 2 | | | All day. | Mild day throughout these 24 hours. |
| Sunday, 8th | Calm. | " | " | 40 | 36 | 37 | | | | " | do do do |
| Monday, 9th | E. | E. | S.E | 38 | 33 | 36 | | | | " | Clear and cloudy; strong breeze in the afternoon. |
| Tuesday, 10th | N.W. | N.W. | N.W | 40 | 37 | 38 | | | All day. | | A very beautiful day, with light breeze throughout. |
| Wednesday, 11th | S.E. | S.E. | S.E | 39 | 35 | 36 | | 2 | | All day | Light breeze; about two inches of snow fell to-day. |
| Thursday, 12th | " | " | " | 40 | 38 | 39 | 1 | 1 | | " | Strong breeze in the afternoon, with showers of sleet. |
| Friday, 13th | " | " | " | 45 | 40 | 43 | All day. | | | " | Light wind all day do |
| Saturday, 4th | N. | N. | N. | 34 | 33 | 34 | | | All day. | | do do beautiful throughout. |
| Sunday, 15th | " | " | " | 40 | 38 | 40 | | | " | | do do do |
| Monday, 16th | " | " | " | 35 | 28 | 30 | | | " | | Moderate, beautiful weather; about four inches of snow on the ground. |
| Tuesday, 17th | " | " | " | 36 | 33 | 34 | | | " | | Light breeze in forenoon, strong breeze latter part. |
| Wednesday, 18th | " | " | " | 42 | 40 | 41 | | | " | | do do evening calm. |
| Thursday, 19th | " | Calm. | S.E. | 42 | 38 | 39 | | | | | Very nice day; towards evening dark clouds in the S.E. |
| Friday, 20th | E. | E. | E. | 40 | 32 | 35 | 6 | 3 | | All day | Nasty day, with strong breeze throughout. |
| Saturday, 21st | S. | S. | S. | 40 | 40 | 40 | | | 3 | 6 | Beautiful day; nice, mild wind. |
| Sunday, 22nd | S.E. | S.E. | S.E. | 45 | 41 | 43 | All day. | | | All day. | Heavy rain; snow nearly all gone; light breeze. |
| Monday, 23rd | " | " | " | 45 | 40 | 42 | 6 | | | " | do strong wind all day. |
| Tuesday, 24th | S. | W. | W. | 43 | 38 | 40 | | | All day. | | Blowing a gale nearly all day; at night moderate. |
| Wednesday, 25th | W. | W. | " | 28 | 25 | 27 | | | " | | Strong breeze throughout the 24 hours. |
| Thursday, 26th | N. | N. | N. | 26 | 20 | 22 | | | " | | Fine, clear day; nice breeze throughout. |
| Friday, 27th | Calm. | S | S.W. | 27 | 24 | 25 | | 2 | | All day. | Calm and cloudy in the morning; strong breeze in the afternoon. |
| Saturday, 28th | S.E. | S.E. | S.E. | 29 | 24 | 26 | | | | " | Strong breeze and cloudy. |
| Sunday, 29th | N. | N. | S.W. | 30 | 24 | 26 | | 6 | | " | About five inches of snow fell to-day; wind variable, with squalls. |

## PORT SIMPSON Weather Table, by Captain Brundige, March, 1880.

| Day. | Winds. | | | Thermometer. | | | Hours of rain. | Hours of snow. | Hours of sunshine. | Hours of cloud. | General Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Morning | Noon. | Evening | Highest. | Lowest. | Mean. | | | | | |
| | | | | ° | ° | ° | | | | | |
| Monday, 1st...... | N. | N. | N. | 26 | 20 | 23 | ............ | ...... | All day. | ............ | Beautiful day; strong breeze throughout the 24 hours. |
| Tuesday, 2nd..... | " | " | " | 27 | 20 | 22 | ............ | ...... | " | ............ | do do do |
| Wednesday, 3rd. | Calm. | Calm. | " | 22 | 18 | 20 | ............ | ...... | " | ............ | Clear and calm forenoon; light air from the north in the evening. |
| Thursday, 4th ... | N. | N. | " | 26 | 23 | 24 | ............ | 2 | 4 | 6 | Very light breeze, with a little snow in the afternoon. |
| Friday, 5th ....... | " | " | Calm. | 30 | 22 | 25 | ............ | ...... | All day. | ............ | Light breeze; forenoon beautiful and clear; calm towards night. |
| Saturday, 6th. ... | " | S.E. | S.W. | 28 | 18 | 22 | ............ | 3 | ............ | All day. | do noon, S.E. with snow; at 4 p.m. a gale from S.W.; light and clear at 10 p.m. |
| Sunday, 7th...... | W. | W. | W. | 42 | 30 | 24 | ............ | ...... | ............ | " | do cloudy but clear throughout the 24 hours. |
| Monday, 8th .... | S.E. | S.E. | S.E. | 40 | 39 | 40 | 3 | ...... | ............ | " | Wind S.E., light; afternoon drizzling rain; at 8 p.m. heavy rain. |
| Tuesday, 9th .... | " | " | " | 42 | 40 | 41 | ............ | ...... | ............ | " | Clear and cloudy fore part of the day; noon hazy; afternoon more clear. |
| Wednesday, 10th | W. | W. | W. | 42 | 38 | 40 | ............ | ...... | All day. | ............ | Light breeze from the west; beautiful clear day throughout. |

## APPENDIX No. 12.

METEOROLOGICAL OBSERVATIONS, BAROMETER AND THERMOMETER READINGS, BY REV. MR. TOMLINSON, AT FORKS OF SKEENA RIVER, FORWARDED BY GEO. R. MAJOR.

| December, 1879. | | | | | | | January, 1880. | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Weather. | | Barometer. | | Thermometer. | | | Weather. | | Barometer. | | Thermometer | |
| Date. | Morn. | Evening. | Morn. | Evening | Morn. | Evening | Date. | Morn. | Evening. | Morn. | Evening | Morn. | Evening |
| 1 | Cloudy. ... | Snow....... | 29·76 | 29 60 | 0 | 4 | 1 | Fine... ..... | Snow....... | 28·95 | 28·78 | 10 | 14 |
| 2 | do ..... | do ..... | 29·59 | 29·13 | 7 | 8 | 2 | Very fine. | Fine... ..... | 28 82 | 29·10 | 8 | — 5 |
| 3 | Fine........ | Fine.. ...... | 29·39 | 29·39 | 9 | 8 | 3 | Cloudy..... | do ..... | 29·15 | 29·12 | — 3 | 0 |
| 4 | Snow. .... | do ..... | 29·36 | 28·18 | 17 | 2 | 4 | Windy...... | do ..... | 29·18 | 29·43 | — 1 | — 7 |
| 5 | Fine......... | do .... | 29·18 | 29·14 | 4 | 18 | 5 | Fine......... | do ..... | 29·55 | 29·58 | —24 | —26 |
| 6 | Very fine.. | do .... | 29·56 | 29 62 | 6 | 9 | 6 | Very fine.. | Very fine.. | 29·47 | 29 48 | —36 | —36 |
| 7 | do .... | do ..... | 29 60 | 29·67 | 10 | — 7 | 7 | Fine.. ...... | do ..... | 29 49 | 29·49 | —32 | —30 |
| 8 | Fine......... | do ..... | 29·57 | 29·57 | — 1 | — 4 | 8 | do ..... | ............ | Mercury frozen. Spirit thermometer registered —67°. | | | |
| 9 | do ..... | Very fine.. | 29·67 | 29·93 | 0 | —20 | 9 | do ..... | ............ | | | | |
| 10 | do ..... | Snow. ..... | 29·97 | 29·67 | —20 | 5 | 10 | do ..... | ............ | | | | |
| 11 | do ..... | Fine......... | 29·62 | 29 62 | 10 | 13 | 11 | do ..... | ............ | | | | |
| 12 | Snow....... | do ..... | 29·56 | 29·60 | 17 | 14 | 12 | Snow....... | Fine......... | 29·59 | 29 50 | —17 | —14 |
| 13 | do ..... | do ..... | 29 67 | 29·62 | 17 | 28 | 13 | do ..... | Snow. ..... | ......... | ......... | — 4 | — 2 |
| 14 | Fine. ....... | do ..... | 29·34 | 29·48 | 24 | 14 | 14 | do ..... | do ..... | ......... | 28·60 | 0 | 13 |
| 15 | do ..... | Snow....... | 29·46 | 29·80 | 24 | 18 | 15 | .............. | .............. | 28·62 | 29·17 | 17 | 11 |
| 16 | do ..... | Very fine.. | 29 99 | 30·12 | 16 | —17 | 16 | .............. | .............. | 29·93 | 29·00 | 30 | 26 |
| 17 | Very fine.. | do ..... | 30·10 | 30 09 | —30 | —28 | 17 | .............. | .............. | 29·39 | 29·62 | 4 | 4 |
| 18 | Fine......... | do .... | 30·09 | 30·18 | —25 | —33 | 18 | .............. | .............. | 29·43 | 29·03 | 17 | 21 |
| 19 | Very fine.. | Fine......... | 30·18 | 29·95 | —32 | —20 | 19 | .............. | .............. | ......... | ......... | ...... | ...... |
| 20 | do ..... | Very fine.. | 29·93 | 29·86 | —24 | —32 | 20 | .............. | .............. | ......... | ......... | ...... | ...... |
| 21 | do ..... | do ..... | 30·02 | 30·11 | —22 | —24 | 21 | .............. | .............. | ......... | ......... | 30 | 28 |
| 22 | Cloudy..... | do ..... | 29·86 | 30·01 | —34 | —34 | 22 | .............. | .............. | ......... | ......... | 19 | — 5 |
| 23 | Fine......... | Cloudy..... | 30·12 | 30 20 | —21 | — 1 | 23 | Fine......... | Cloudy..... | 29·22 | 29·04 | 5 | 16 |
| 24 | H'vy snow | Fine... .... | 30·11 | 29·75 | 4 | 10 | 24 | do ..... | Fine... ..... | 28·90 | 29·02 | 12 | 0 |
| 25 | Cloudy..... | Snow....... | 29·57 | 29·36 | 20 | 18 | 25 | do .... | Very fine.. | 29·20 | 29·32 | 5 | —12 |
| 26 | Snow. .... | Cloudy..... | 29·30 | 29·42 | 21 | 20 | 26 | Very fine. | Cloudy..... | 29·48 | 29·66 | —25 | — 4 |
| 27 | Very fine.. | Very fine.. | 29·73 | 29 88 | —10 | —29 | 27 | do ..... | do ..... | 29·90 | 29·89 | —25 | 0 |
| 28 | do ..... | Fine......... | 29·79 | 29 63 | —32 | —12 | 28 | Snow....... | Fine......... | 29·70 | 29·70 | — 1 | 2 |
| 29 | Snow....... | do ..... | 29·30 | 29 36 | — 2 | — 2 | 29 | Cloudy..... | Snow....... | 29·77 | 29 70 | — 5 | 10 |
| 30 | do ..... | do ..... | 29 40 | 28 93 | 4 | 11 | 30 | Fine........ | Cloudy..... | 29·70 | 29·66 | 13 | 22 |
| 31 | Fine........ | Very fine. | 28·87 | 29·03 | 10 | 4 | 31 | do ..... | Fine......... | 29·66 | 29·86 | 34 | 30 |

# APPENDIX No. 13.

## THE PHYSICAL CHARACTER OF THE PRAIRIE REGION OBTAINED FROM AUTHENTIC SOURCES.

The Prairie Region has been arbitrarily defined in previous reports as extending from the eastern boundary of British Columbia to a line drawn northerly and southerly from Lake Winnipeg. This great central area of Canada is not all prairie, but a considerable portion of it, especially towards the south, is of a prairie character; in other parts much of the Territory consists of woodland. It is, however, held convenient to retain for the whole extent the term of 'Prairie Region.'

The information in the following pages, compiled under instructions from the Engineer-in-Chief, by Mr. Thomas Ridout, C.E., is designed to embrace all important information reported by the several Explorers during the year 1879, which, together with that contained in Appendix No. 1 of last year's Report, is intended to present in a concise form all the leading facts found on record, respecting the physical characteristics of this Territory.

## EXPLANATORY NOTE.

The whole Territory is divided into sections, each section one degree of Longitude in breadth by one degree of Latitude in length.

The numerals in the margin, in a fractional form, thus $\frac{55}{100}$ indicate the particular section in each case. The numerator referring to the Latitude and the denominator to the Longitude.

Thus "55" means the space lying between the 55th and 56th parallels of Latitude, while "100" refers to the space between the 100th and 101st meridian.

The numbers printed in red on the map indicate the several sections.

***The information now furnished is from the Explorations of* 1879. *The Examinations did not extend north of latitude* 56°, *except in the vicinity of Peace River, where they reached latitude* 57°. *References to Sections*** $\frac{59}{100}$ ***to*** $\frac{56}{116}$ ***inclusive, will be found in the Report of* 1879.**

### FROM THE 117TH TO THE 122ND MERIDIAN, AND BETWEEN THE 56TH AND 57TH PARALLELS OF LATITUDE.

$\frac{56}{117}$ *Cambie Exploration,* 1879.

Mr. H. J. Cambie, C.E. in going from Lesser Slave Lake to Peace River, travelled north-westerly through the southern portion of the section.

Passing through one strip of prairie, 10 miles in length, with rich soil producing luxuriant grass and pea vine; also some small prairies on slopes facing the south. The other portion of the road lay through groves of poplar and spruce, generally of small size of 3 to 12 inches in diameter, on soil of grey silt with two to four inches of vegetable mould."

See, also, *Appendix Canadian Pacific Railway Report,* 1879.

$\frac{56}{118}$ *Cambie Exploration*, 1879.

Mr. Cambie passed westerly from the mouth of Heart River, on the north side of Peace River, through the southern portion of this section.

"At the mouth of the North Heart River the Hudson Bay Company have an extensive storehouse, from which are distributed the supplies, etc., destined for the Lower Peace River, and the Posts far north on the Mackenzie.

Here we crossed the Peace, and continued our journey up its left bank on an open bench with poor gravelly soil, to the old trading post opposite Smoky River, established in 1792 by Sir Alexander Mackenzie, which has now been abandoned; and then ascending to the plateau by the cart trail, followed it to Dunvegan, nearly fifty miles in all.

The trail takes a moderately direct course, and is at one point about twelve miles distant from the valley of Peace River. It led us through a nearly level country, having an average elevation of 1,900 feet above sea level, with very rich soil, about one fifth prairie and four-fifths poplar and willow copse, the timber being too small to be of value except for firewood and fencing.

Of the twenty miles next to Dunvegan, fifteen are in large open prairies, with rich grass, and such a depth of black vegetable mould that prodding with a stick to the depth of a foot, we failed to reach the sub-soil.

Between the Smoky River Post and Dunvegan, forty-five miles, we crossed one running stream, the North Brulé, 10 feet wide, 12 inches deep, with a swift current, beside two small watercourses with stagnant pools, and we passed a lake one mile long by half a mile wide.

The supply of water is scanty, but the route of the trail seems to have been specially selected, with the view of passing between the heads of the streams draining south into Peace River direct, and those draining north into a river which joins the Peace a few miles below Smoky River.

In the whole trip from Dunvegan to Lesser Slave Lake and back, about 260 miles, solid rock was only seen once at the crossing of Peace River; very few boulders were noticed; and though some of the land is light, by far the greater proportion is rich, and will become a splendid farming country if the climate proves suitable."

See, also, *Appendix Pac. Ry. Rep.*, 1879.

### GENERAL REMARKS ON WEATHER.

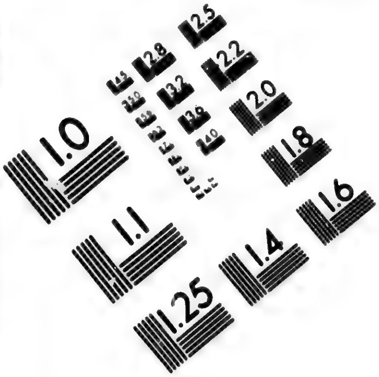
"The gardens at Hudson's Hope, Fort St. John, and Dunvegan, are in the valley of Peace River, many hundred feet below that level, and they have also the advantage of a great deal of heat, reflected from the adjacent hills. In this connection it is right to mention that all the seed used by the people in the Peace River district has been grown year after year in the same ground, and generally without manure, also that they have not the most improved and earliest varieties of either grain or vegetables.

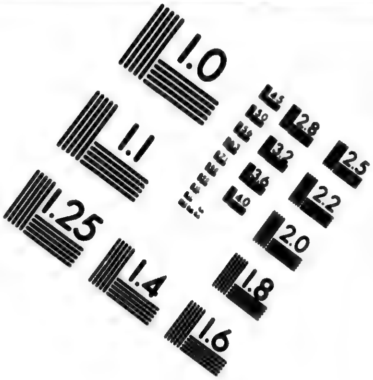
Eastward of Hudson's Hope it is said that snow seldom lies to a greater depth than two feet, and horses winter in the open air; when it attains that thickness, however, they resort to the slopes of the valley facing the south, where the snow drifts off, leaving the grass bare.

We had been in the valley of Peace River, from the mountains to Dunvegan, in the latter part of July, and the weather was then warm and mild.

The month of August was spent between Dunvegan and Lesser Slave Lake, and twenty-three days of it on the plateau.

During that time there was frost on the morning of the 6th, though the thermometer at 5 a.m. had risen to 46°.





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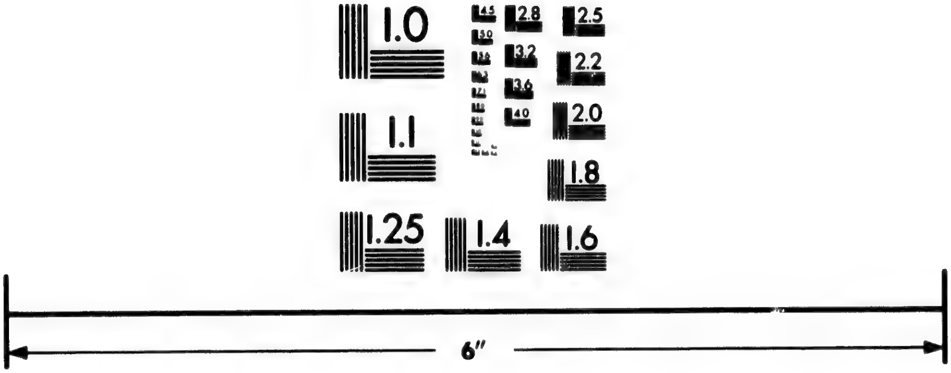

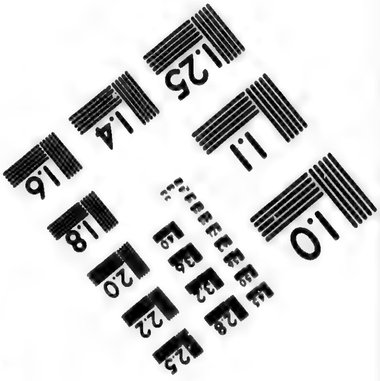

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2.8
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Again, on the 26th, when it was still 5° below the freezing point at 5 a.m., and on the 27th when it had risen to 35° at 4.30 a.m.

On the other twenty days the lowest reading, between 4.30 and 5 a.m., was 39° and the highest 65°. The weather was clear and fine, and in the afternoon it was often warm enough to send the thermometer up to 80° in the shade.

From the time of leaving Dunvegan, September 5th, till we passed Moberly's Lake, on the 16th, we were on the level of the plateau, and might still be considered east of the mountains. There was frost on eight nights out of the twelve.

While breakfasting at 5 a.m. on the 9th, the thermometer still stood at 20°, and on three other mornings it had not risen above the freezing point at that hour. During that time the weather was generally clear and bright.

We had fine but cold weather from the 17th till the summit of Pine River Pass was crossed on 28th, and from that time till we reached Quesnel on Oct. 17th, it was decidedly wintry, with hard frosts."

56

119 *MacLeod Exploration*, 1879.

Mr. Henry A. F. MacLeod, M.I.C.E. travelled down Peace River from St. John to Dunvegan, across the southern part of this section.

" From St. John to Dunvegan the soil is rich and suitable for agriculture for a considerable distance on each side of Peace River. The seed time commences about the end of May. The service berry is very abundant in the neighborhood of Dunvegan and St. John, and large game moose and bear are numerous. A few buffalo are reported to have been seen in the spring near Mud River."

*Cambie Exploration*, 1879.

### DUNVEGAN TO FORT ST. JOHN.

" From Dunvegan we travelled northward for a day and a half, say 30 miles, and then westward at an average distance of 15 miles from Peace River to Fort St. John, reaching it on the 12th.

For the whole distance, nearly 120 miles, the plateau undulates considerably, ranging from 1,900 to 2,400 feet above sea-level. And for 40 miles, after turning to the west, there was a range of hills a few miles to our right, rising from 600 to 1,500 feet above the adjacent country. My guide informed me that the streams on the other side of that ridge drained into the Battle and Liard Rivers.

Eleven streams, from 12 to 40 feet in width, were crossed, besides numerous smaller ones, and Pine River North, which is situated about six miles from Fort St. John, and was then 100 feet wide by two feet deep, but at high water must be 300 feet wide, in a valley 700 feet deep and a quarter of a mile wide in the bottom. The slopes on both sides are much broken by old land-slides.

On the west there is a bluff of decomposed shale, and on the face of the eastern slope many ledges of sandstone in nearly horizontal beds.

We saw a few small open muskegs, and had to cross one about one mile in width which delayed us more than four hours.

The soil is composed of white silt with a good covering of vegetable mould, but for one stretch of 14 miles, this has been completely burnt off. We also passed over two gravelly ridges.

A few large prairies were seen, and many small ones interspersed with poplar and willow copse.

Twenty-five per cent of the distance lay through woods of small poplar, spruce and black pine. Near Pine River North there was also a belt three miles wide of spruce six to fifteen inches in diameter.

Fort Dunvegan, August 1st-5th. In the garden of the fort there were fine crops of wheat, barley, potatoes, beets, cucumbers and squash, while at the R. C. Mission close by there were fine potatoes, onions, carrots, and a luxuriant, but very backward, crop of wheat, a condition of things which Mr. Tessier, the priest, explained to us had resulted from a long drought, causing the grain to lie in the ground without sprouting till some heavy rain occurred at the end of May. August 28th to September 5th, wheat at the fort was cut, but was not perfectly ripe; that at the Mission was injured by frost, and no hope of its ripening; all other crops had succeeded well."

*McConnell Exploration*, 1879.

This information has been communicated by Dr. G. M. Dawson, Geological Survey from notes taken by his assistant, Mr. R. McConnel, 1879:—

Mr. R. McConnell travelled northerly through this section, on his way from Dunvegan, on the Peace River, to Battle River of the North, about 85 miles.

"For several miles after reaching the plateau level, the country passed through was somewhat rolling and dotted with aspen copse, but gradually the rolls ceased, and at a distance of about six miles from the river the country becomes almost perfectly level; as far as the eye could reach nothing met the view but a level plain with here and there a clump of aspen. In no part of my summer wanderings did I see any section of the county which, from an agricultural point of view, surpassed this. The soil displayed, where the trail had been worn somewhat deeply, was a heavy clay covered with a rich black mould, often over a foot in depth. Neither swamps nor muskegs, and but two gullies were passed over or seen in any direction. This style of country continued for a distance of about 15 miles from the Peace River, and it then commenced gradually to change for the worse. Approaching Hay Lake, the country became more swampy and woody, while with the aspen were now mixed a considerable number of spruce, a sure sign of a deterioration in the quality of the soil." After passing through a rather broken country, and seeing two lakes of some size, he crosses numerous swamps and muskegs and descends into the valley of the White Mud River, about 45 miles from Dunvegan.

"Passing with difficulty through this swamp, which is about three miles in width, the country gradually improved; first swamp and aspen bush alternating with one another, then all aspen bush, and at last an open prairie. About six miles from the foot of the hills, we came to a large stream, called White Mud River, about 50 feet in width by about a foot and a-half in depth, it flows in an easterly direction and the country we descended into appeared to be its valley, which is about 15 miles in width, but seems to narrow westward, another range of hills running from the south-east appearing to almost close it up. Between these two ranges of hills, and stretching eastward and south eastward, as far as the eye could reach, is a large area of magnificent country slightly rolling, and covered here and there with clumps of aspen and willow. This reach of country, according to Half-Breeds reports, follows White Mud River to its mouth, and bears the same character throughout. This would make it about 50 miles in length with probably an average width of 20 miles. It appears to be about the same height as the plateau above Dunvegan."

"After leaving White Mud Prairie, the country grows worse, the proportion of swampy land being on the increase, also the prairie land giving way to aspen bush; but getting past the water-shed between White Mud River and Battle River, it again improved, and from this point on to Battle River, a distance of about 25 miles, it maintained the same general character, containing scarcely any prairie, but being covered with a thick growth of aspen and willow, and with a very small proportion of swampy land."

"Battle River flows in a valley about a mile in width and about 200 feet in depth. The river itself is, at low water, about 75 feet in width and about a foot deep, during floods must it be a large stream of a couple of hundred feet wide and three to four feet deep. A walk of several miles up and down the stream discovered no stratified rocks *in situ*, though several bluffs were seen from 50 to 75 feet high, but consisting principally of sand."

"According to the account of a Cree hunter whom we met there, it receives two branches from the south, each as large as itself, before rolling into Peace River, which, according to him, was two days' journey from this point, probably about 40 miles.

"As a rough estimate of the amount of good land lying between Peace River and Battle River, a distance of 85 miles, I should say that fully three-quarters of it is fit for cultivation, the rest being wet; and the greater part of the former, including the White Mud River Prairie, being really first-class land, equal to any that I have seen in any other place in the North-West.

At Battle River the fall appears to set in very early, although it was but the 24th of August when we were there, yet the leaves of the aspen were all turned yellow and were falling off. This appears to have been due to the frost of the 20th August, when the thermometer registered 12 degrees of frost, as before that they were quite green, and on our way back, after re-crossing the hills, we found them again comparatively green. This frost, according to Hudson Bay Officers' report, was quite exceptional in its severity at so early a season; but, besides it, two other slight frosts were experienced on the trip."

See, also, *Appendix Pac. Ry. Rep.*, 1879.

56

120 *MacLeod Exploration*, 1879.

Mr. Macleod descended the Peace River from Hudson's Hope to St. John.

"Between Hudson's Hope and St. John the soil improves and is everywhere fit for pasturage, and in many places rich and suitable for agriculture."

*Cambie Exploration*, 1879.

### FROM ST. JOHN TO HUDSON'S HOPE.

"My trip from Dunvegan to Fort St. John had occupied a longer time than anticipated, and the season was now so far advanced that I did not dare to linger on the road, but hurried on, keeping the trail to Hudson's Hope. Most of the way it followed the valley of the river and was on the plateau only for twelve miles after leaving Fort St. John, for about three miles near Middle River, half-way between the two places, and again for a short distance about six miles east of Hudson's Hope.

The soil is rich at each of these places, with prairie and poplar and willow copse, also a few small groves of poplar and spruce four to twelve inches in diameter.

On the benches next the river, the soil is in some places light, and between Middle River and Hudson's Hope, there is one stretch, six miles in length, gravelly and almost barren. That description of land also extends the whole way across the Rocky Mountain portage.

We crossed only one stream of importance, Middle River, which was then four feet deep by 150 wide, and at time of freshet 450 feet wide, besides three others from 12 to 25 feet across, with a few very small ones.

On the east side of Middle River, and about 15 miles north of the Peace, a range of hills 1,000 or 1,500 feet high was observed running nearly east and west.

Fires were raging in the bush in many places, and we had to ride through one belt of woods burning briskly at the time, which we did with difficulty, as the smoke and ashes were blinding, and the heat very great; fortunately the timber was fairly open or we should have been stopped.

Regarding the country north of Peace River, I noticed that from the eastern base of the Rocky Mountains, about twenty miles north of Hudson's Hope, a range of hills extends nearly due east till it meets the Peace River, about twelve miles below its junction with Smoky River.

The tract of country lying south of that range, and between it and the Peace, is generally fertile, but that portion of it west of the longitude of Dunvegan is more undulating and at a slightly higher elevation than the other portions of the plateau in the Peace River district, which I had travelled over, and has an appreciable percentage of poor soil.

Fort St. John, July 30th. The garden contained some good potatoes, onions and turnips, and a negro named Daniel Williams had a small patch of excellent barley. On September 12th the crops were all ripe, and excellent both as regards quantity and quality, but the barley had been trodden down by animals and much of it eaten, the owner having been arrested and taken to Edmonton on some criminal charge."

See, also, *Appendix Pac. Ry. Rep.*, 1879.

$\frac{56}{121}$ *Cambie Exploration*, 1879.

" Hudson's Hope, July 27th–29th. The soil in the garden is a good sandy loam, and onions were very fine; all other crops had been injured by a severe frost about May 15th; beans were killed, so were the potato vines, but they had started afresh. A little patch of wheat had been frozen, but had grown up again, and a few stalks were forming ears; carrots and cabbage looked well. It was said that the frost in May was confined to the valley, and did not extend to the plateau.

Horses have wintered in the open air for many years, but in the winter of 1875–6 twenty out of a band of twenty-four perished on account of the deep snow.

Returning there September 14th–16, we found the potatoes had produced only a very poor crop, and the wheat had been again frozen while the grain was in the milk stage, rendering it useless."

See, also, *Appendix Pac. Ry. Rep.* 1879.

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FROM THE 100TH TO THE 123RD MERIDIAN, AND BETWEEN THE 55TH AND 56TH PARALLELS OF LATITUDE.

$\frac{55}{100}$ See *Appendix Pac. Ry. Rep.*, 1879.

$\frac{55}{101}$ See *Appendix Pac. Ry. Rep.*, 1879.

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102 *O'Keeffe, Exploration*, 1879.

Mr. Clarke, Assistant to Mr. D. C. O'Keeffe, proceeding south-easterly from Frog Portage to Cumberland House, passed through the south-western corner of this section.

At Pelican Narrows, where there are Roman Catholic and Church of England Missions, and also a Hudson's Bay Post, small gardens of potatoes were seen. Soil clay, mixed with a good deal of sand. Into the northern arm of Pelican Lake flows Bear River, which takes its rise in a lake lying to the east. Whole region rocky and sterile.

See, also, *Appendix Pac. Ry. Rep.*, 1879.

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103 *O'Keeffe Exploration*, 1879.

Mr. Clarke, proceeding south-easterly from Isle La Crosse Lake to Cumberland House, crossed the middle of the southern half of this section.

From Rapid River to Frog Portage, where he left the English River, the whole country was rocky and sterile. After he left Frog Portage the country was of the same character until he left this section. The wood seen was stunted aspen and birch.

See also *Appendix Pac. Ry. Rep.*, 1879.

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104 *O'Keeffe Exploration*, 1879.

Mr. Clarke passed through this section south-easterly on his way to Frog Portage from Lake La Crosse.

Along English River, in this section, nothing but rock, sand and swamps is recorded.

From the centre of the section, Mr. Clarke made a branch expedition south of Lac La Ronge, which lies at the southern extremity of it. This lake is full of fine fish, as are all the lakes throughout the country. On the portage, at the north end of the lake, some clay soil was seen, and pea vine and vetch are spoken of as growing in the burnt timber.

See, also, *Appendix Pac. Ry. Rep.*, 1879.

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105 *O'Keeffe Exploration*, 1879.

Mr. Clarke passed through the middle of the northern half of this section on his way from Isle La Crosse to Frog Portage.

He reports the river as consisting of lake expansions and short rapids. Land of no value whatever. "The southern portion consisting of muskeg and small lakes."

See also *Appendix Pac. Ry. Rep.*, 1879.

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106 *O'Keeffe Exploration*, 1879.

Mr. Clarke crossed the middle of the northern half of this section, proceeding easterly on his way from Isle à la Crosse to Frog Portage.

The northern portion of this section consists of syenite and gneiss rock, while the southern half is occupied with sterile sandy plains, muskeg and small lakes. Small fir and poplar, with Banksian pine, are the only trees.

In an excursion made from the Beaver River eastward to Burnt Mountain, Mr. Clarke crossed the most southern portion of the section.

Lac La Plonge, which is situated partly in the south-western corner of this section, is 30 miles long by 8 to 12 miles in breadth.

"From the south-east end of the lake, we penetrated to Burnt Mountain, first crossing an extensive sand ridge, on which was a fair growth of Banksian pine, poplar and birch. At the base, on each side for a short distance, the wood is tamarac." On leaving this ridge, the country is described as being a plain 9 miles wide, consisting of rocks and boulders covered with moss in places to a depth of 3 or 4 feet. Other sections are covered with a little vegetable mould, but no vegetation, except blueberries. The country is similar for 20 miles north and south.

There is a poor growth of stunted Banksian pine to be met with generally.

A ridge covered with poplar, and having a surface soil of sandy loam, was passed, but the country generally, is as described above.

See also *Appendix Pac. Ry. Rep.*, 1879.

55/107 *O'Keeffe Exploration*, 1879.

Mr. Clarke entered this section from the south on his way down Beaver River from Green Lake to Isle La Crosse.

A little distance north of latitude 55°, the Beaver River assumes larger proportions, and forms several marshy lakes, varying in width from one to two miles. Nearing Lake La Crosse he says, "The country about here is sandy on the high ground, and muskeg on the low, timbered with Banksian pine and poplar of poor quality. The marshes on each side of the river produce large quantities of coarse grass. Arriving at Isle La Crosse Lake, the water presents the same thick green appearance as Green Lake. This is caused by small particles of green vegetable matter."

"Near the Hudson's Bay Post is a Roman Catholic Mission with a small farm attached, on which they, with difficulty, raise barley and potatoes for their wants. The Hudson's Bay Company also tried to farm, but gave it up, except some small patches for potatoes and barley. The soil consists of loam mixed with a large proportion of white sand."

The northern portion of this section along English River, contains some muskeg, but is generally extremely rocky, granite and gneiss being the prevailing rocks. In the centre it is sandy, and continues so along the shores of Isle La Crosse Lake, which are thickly wooded with Banksian pine. The southern portion consists of sandy plains, muskegs and tamarac swamps south and west of Lac La Plonge. To the south and east of Lac La Plonge, there are some good tamarac and spruce.

See also *Appendix Pac. Ry. Rep.*, 1879.

55/108 See Appendix, Pac. Ry. Rep., 1879.

55/109 See Appendix, Pac. Ry. Rep., 1879.

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110 See Appendix, Pac. Ry. Rep., 1879.

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111 *Eberts Exploration,*—1879.

Mr. Melchior Eberts explored the south-west corner of this section, and found it to be nothing but sand hills and muskeg in the valleys, and no grass except on the borders of the lakes. Timber consisted of Banksian pine, tamarac and spruce, the latter covered with moss.

See Appendix, Pac. Ry. Rep., 1879.

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112 *McConnell Exploration,* 1879.

Mr. McConnell crossed the south-easterly corner of this section, on his way from Athabasca to Lac la Biche.

" Leaving the Athabasca, at the mouth of the Lac la Biche River, the road passes for about 5 miles through an aspen bush, and ascended a slight elevation. The country appeared to be almost level, and to be a mere succession of aspen ridges and muskegs. Descending from this elevation, we found a large swamp at the foot of it."

" A narrow strip of good land follows the river and explains why the road hugs it so closely, but looking away from the river the country appears to be a mere worthless mass of muskegs, the good land intervening between them being of too small extent to be of any use."

" Lac la Biche is about 15 miles in length, and 4 to 5 in breadth near its centre. The land around the lake, although not equal to that in the vicinity of Edmonton, is yet very good. It appears to rise up from the lake to a height of about 150 feet in 2 or 3 miles, and is rather rough; and some of the higher rolls are gravelly. Still, by far the greater part of the land lying round the lake is fairly good, and will, no doubt, some day, be largely settled."

" The effect of the Roman Catholic Mission at Lac la Biche is seen in the number of small wooden houses and small patches of land fenced in, which are seen nearly all round the lake, although these patches are usually small in themselves, yet in the aggregate they amount to a good deal. From the stubble I judged that the crops must have been very good, although I could obtain no statistics on this point owing to the inhabitants being all away engaged in the fisheries."

See Appendix, Pac. Ry. Rep., 1879.

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113 *Gordon Exploration,* 1879.

The Rev. D. M. Gordon passed down the Athabasca from the mouth of Little Slave River, in the south-western corner of this section.

" At the junction of the two rivers the Athabasca is about 200 yards wide, with a current of about two and a half miles per hour. It broadens out in its further flow, but its current continues much the same for many miles.

The land on either side is wooded with poplar, interspersed with spruce; the banks rise by gentle slopes to a height varying from 100 to 200 feet; the soil seems good, though light, covered occasionally with luxuriant pastures, but for the most part lightly timbered."

### *McConnell Exploration*, 1879.

Mr. McConnell crossed the south-eastern corner of this section, on his journey down the Athabasca from Athabasca Landing to Lac la Biche.

"The valley presented a nearly uniform character throughout, ranging from a mile to two miles in breadth. The river winding from one side of the valley to the other caused the flat forming the bottom to alternate from one side of the stream to the other. A rather singular fact is the decrease in the height of the plateau, which at the Landing is 350 feet above the river, while, at River La Biche, it is only 200 feet." This is an important fact, showing the general fall of the country towards the north, the same fall having been observed on the Peace River, by Mr. Macoun.

See also *Appendix, Pac. Ry. Rep.*, 1879.

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### *Gordon Exploration*, 1879.

Mr. Gordon proceeded down Lesser Slave Lake and River easterly to the Athabasca.

"The small river that forms the outlet of the lake is about 25 yards in width, very tortuous, hemmed in by low banks that are almost uniformly wooded with aspen copse and willow, between which it winds with very gentle current at a depth sufficient for large Hudson Bay Company's boats heavily laden. The soil on either side near the river seems excellent sandy loam, and where free of timber abounds in rich grass and pea vine. Ere it joins the Athabasca the river widens to a span of 50 yards, and passes over a series of gentle rapids, while its banks become more varied in contour, though still closely wooded."

### *McConnell Exploration*, 1879.

Mr. McConnell traversed the centre of the southern half of this section on his way from the eastern end of Lesser Slave Lake to Fort Assiniboine, on the Athabasca.

"Leaving Lesser Slave Lake at its outlet, we struck out in a south-easterly direction for Fort Assiniboine. After leaving the lake for a short distance the ground is marshy, but gradually became firmer as we advanced, opening into a beautiful prairie several miles in width, covered with a luxuriant growth of wild hay and pea-vine. About six miles from the lake, came to a range of hills running east and west. The crossing of these hills was extremely difficult, owing to almost continuous muskegs and swamps, and at the southern side a large stream flowing into the Athabasca was met with."

A few miles south of this stream a low ridge was crossed, running from east to west, which marked the beginning of quite an extensive reach of good land, through the centre of which flows a large stream about 75 feet wide. Passing farther to the south, another stream, flowing into the first-named, is crossed, and the valleys of both rivers spoken of as being very fertile.

"Near the latter stream the country is almost entirely open, being merely dotted here and there with clumps of willow, but away from the stream it becomes densely wooded with a small growth of aspen. Through this aspen bush we travelled for about seven miles, a glimpse from a slight elevation revealing the same general character of country extending indefinitely eastward."

"Ten miles from the river the land again changed for the worse, and from this point to Fort Assiniboine the country generally was swampy or sandy, and of no value for agriculture."

"Indeed, from the outlet of Lesser Slave Lake to Fort Assiniboine, on the Athabasca, with the exception of a few miles on either side of the A-ke-new-si-pi, there is scarcely any part of the entire distance of 65 miles at all fit for agricultural purposes."

See also *Appendix, Pac. Ry. Rep.*, 1879.

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115 *Cambie Exploration*, 18

Mr. H. J. Cambie describes the vicinity of Lesser Slave Lake:—

"We reached the western end of Lesser Slave Lake, 1,800 feet above sea level, on August 19th, and next day walked round the head of the lake, about seven miles, to the Hudson Bay Company's fort of the same name. Our path led us across Salt Creek, 50 feet wide, coming in from the north-west, which is bordered for a mile on each side by rich marsh meadows. They are subject to overflow in spring and during the early part of the summer, but at the time of our visit, they were nearly dry, and on many parts a mowing machine might have been used to advantage.

The grass is coarse in quality, but is said to be very nutritious, and a large quantity of hay per acre might be saved.

The western extremity of Lesser Slave Lake is a circular pond, about four miles in diameter, which is connected by a network of channels about a mile in length, with another pond of nearly the same size, which in its turn is connected with the main lake by a channel about three miles in length. These ponds are quite shallow, seldom exceeding four feet in depth, and between them, as well as to the south of them, marshes similar in every respect to that next Salt Creek stretch away for miles.

The fort stands just at the outlet of the first pond; the upland is there light and sandy, with a small growth of poplar, spruce, alder and willow.

Lesser Slave Lake, August 20th. In the garden of the fort were peas, beans, turnips, carrots, potatoes and rhubarb, all looking well. And in the garden at the R. C. Mission were the same vegetables, also onions, cabbages, barley (good), with some very fine wheat almost ripe, and quite beyond the reach of any frost likely to occur at that season. The success of these crops at an altitude of 1,800 feet above the sea, and therefore nearly on the general level of the plateau, east of the Rocky Mountains, is a matter of some importance."

*Gordon Exploration*, 1879.

Mr. Gordon speaks thus of the Lesser Slave Lake:—

"Around Lesser Slave Lake there are large marshes, yielding abundance of excellent hay, and in this neighborhood wheat has been grown with marked success, although as yet in very small quantity. To the south of the lake the country is hilly, though near the margin of the lake the land is very swampy; to the north there are numerous marshes, lakelets and streams."

*McConnell Exploration*, 1879.

Mr. McConnell travelled north through the western margin of this section for a distance of 25 miles from the Hudson Bay Post, on Lesser Slave Lake.

"For the first 10 miles after leaving the lake, near the mouth of Salt Creek, and going in a north-easterly direction. the trail leads partly through open prairie and partly through aspen copse; the country is very rolling, the hollows being usually swampy and the soil on the higher ground tolerably fair. But from the trail large muskegs could be seen on either side wholly worthless for any purpose. The trail appears to wind along a ridge, and so to show more good land than would appear from a line taken straight north from the lake at random. For the next ten miles the country is much more woody, the trees principally consisting of aspen with some spruce, and the proportion of swampy land being very evidently on the increase, until, about 20 miles north of the lake, it culminated in what is called "Le Grand Muskeg," a belt of land 10 to 12 miles wide, running east and west, and wholly given up to swamps. Into this we carefully picked our way for three to four miles and then returned. Up to the edge of "Le Grand Muskeg" I should say that about two-thirds of the land passed over was fairly good, the remainder being too swampy to be useful for any purpose."

Mr. McConnell was informed that north of "Le Grand Muskeg," the country improved a little, and in the vicinity of White Fish Lake, situated a short distance north of the large muskeg, was some very good land and a few gardens.

See also *Appendix, Pac. Ry. Rep.*, 1879.

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116 *Cambie Exploration*, 1879.

Mr. Cambie crossed the centre of this section, proceeding north-easterly from Little Smoky River to Lesser Slave Lake.

"Continuing the same course, at about seven miles we passed Iroquois Lake, one and a half miles long and three-quarters of a mile wide.

It discharges into Little Smoky River, being about 230 feet higher, and is separated only by a swamp from another lake of the same name, which empties into Lesser Slave Lake.

About seventeen miles from the Little Smoky, we crossed South Heart River, 60 feet wide, shallow, and with a current of two miles per hour, running in a valley a quarter of a mile wide and 60 feet deep.

Still continuing the same north-east course for about eleven miles, with the river not far to our right, we reached, August 19th, the western end of Lesser Slave Lake, into which it discharges.

The country from Sturgeon Lake to South Heart River is not so swampy or so much flooded by beaver as between Smoky River and that lake, but the timber and soil are precisely similar.

For one and a half miles after crossing South Heart River, we passed through a belt of black pine, on poor sandy soil, and then across a tamarac swamp half a mile in width; but from that point to the head of Lesser Slave Lake, our path lay along the face of a gentle slope facing the south-east, through a prairie of good grass, pea vine and some small sage, with poplar and willow copse.

The soil is grey silt, with several inches of black vegetable mould."

Mr. Cambie travelled north-westerly through the northern half of this section on his way from Lesser Slave Lake to Peace River.

"At Lesser Slave Lake we were presented with a supply of white fish, weighing from three to four pounds each, similar in every respect to those found in the great North American lakes.

We left there August 21st, on our homeward journey, following the Hudson Bay Company's cart trail in a north-westerly direction towards Peace River.

About eleven miles from the lake we crossed the South Heart River, which was there 40 feet wide, coming from the north-east, and followed up some of its smaller tributaries to the twentieth mile.

Three miles farther we crossed a creek about 8 feet wide which flows into the North Heart River, and followed the general direction of that stream to its confluence with the Peace, three miles below the mouth of Smoky River, and fifty-five from the western end of Lesser Slave Lake.

In the first five miles from the lake the trail ascends 400 feet and then descends gradually with many unimportant undulations towards Peace River, which is there about 900 feet above sea level, 1,300 feet wide, its immediate valley being 700 feet deep. We crossed a muskeg one mile wide, and travelled along the margin of another for half a mile, beside many small swamps which could be drained without difficulty."

See also *Appendix, Pac. Ry. Rep.*, 1879.

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117 *Cambie Exploration*, 1879.

Mr. Cambie crossed this section south-easterly on his way to Lesser Slave Lake from Dunvegan.

"We found a party of Crees and half-breeds hunting on Smoky River, who ferried us across in a canoe at a point about eight miles south of the Bad Heart.

The valley is there 450 feet deep and two miles wide at the level of the plateau.

The western bank was an irregular slope with many small hollows containing pools, caused by a series of land-slides.

My guide kept travelling south-east, and insisted he was taking the shortest route to Lesser Slave Lake, but after four days he brought us to Sturgeon Lake, five miles long by four broad, elevation above sea level about 1,900 feet; where there is a settlement of Crees.

I estimated that we had travelled during the four days only about forty-one miles. A very large proportion of the country is flooded by beaver, and we spent hours picking our way between ponds, wading across swamps, and bridging small streams with muddy banks in order to get our horses over. No streams of importance were crossed.

There are numerous swamp meadows, but very little, if any, true prairie; the timber is poplar, spruce, birch, willow and black pine (*Pinus contorta*), all of small size, in a few cases nine to twelve inches, and two small groves of spruce nine to eighteen inches diameter were noticed.

The highest point passed over was about 2,100 feet above sea level; the country undulates gently, and if the beaver dams were cut away it could be drained with very little labor; the soil is white silt with four to six inches of vegetable mould.

The boulders and shingle on the beach of Sturgeon Lake were all granite and with them was a quantity of white quartzose sand."

From Sturgeon Lake in the centre of the southern portion, Mr. Cambie travelled north-easterly in the direction of Lesser Slave Lake.

"It was very annoying to find that I had been led many miles out of my course and through swamps, to this lake, in order that my guide might have the pleasure of visiting some of his Indian friends; nevertheless such was the fact, and we had now to take a direction at right angles to our former one and travel north-eastwards towards Lesser Slave Lake.

About thirty miles brought us to little Smoky River, 400 feet wide, in a valley 250 feet deep and one and a half miles broad, at the level of the plateau. The estimated elevation above sea level is 1,600 feet, depth two and a half feet, current 4 miles per hour.

Sturgeon Lake is one of the feeders of this river, but its principal source is in the range of mountains to the south of Lesser Slave Lake, and it discharges into the main Smoky, about 15 miles below the mouth of the Bad Heart River, before referred to.

The beach and bars of this river consist of well rounded boulders and shingle of granite, with some large masses of sandstone, not much water-worn; also numerous pieces of lignite, but no rocks were seen in beds, and there were no means of ascertaining from what distance they had drifted.

It is worth mentioning that a little before we reached this stream a stone about the size of my fist was met on the trail, and all the members of my little party stopped to examine it, not having seen one of any kind for days before."

*Dawson Exploration*, 1879.

Dr. Dawson, crossed this section in its south-western part, on his way from Pine Pass.

" East of the Smoky River and southward towards the Athabasca the prairie country is quite insignificant in extent, the region being characterized by second growth woods of small size, which on approaching the Athabasca are replaced by extensive and well nigh impassable brulés and wind-falls in which second growth forest is only beginning to struggle up.

Though the prairies are most immediately available from an agricultural point of view, the regions now covered with second growth and forest where the soil itself is not inferior will eventually be equally valuable."

See also *Appendix, Pac. Ry. Rep.*, 1879."

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118 *Dawson Exploration*, 1879.

Dr. Geo. M. Dawson, D.S., A.R.S.M., F.G.S., traversed this section from west to east, south of its centre.

The country is described as high plateau to the west of Smoky River, with extensive areas of prairie country, either perfectly open and covered with a more or less luxuriant growth of grass or dotted with patches of coppice and trees. What is not prairie or coppice is described as being generally covered with a dense growth of second growth aspen. On other parts some of the old forest remains and consists of large aspen and balsam poplar and spruce. The better class of forest is found in the river valleys.

See also *Appendix, Pac. Ry. Rep.*, 1879.

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119 *Cambie Exploration*, 1879.

Mr. Cambie, in travelling from Dunvegan to Lesser Slave Lake, traversed the north-western corner of this section:—

"The first four miles, while ascending to the plateau, were through timber, and the soil appeared cold and wet. Again, from about the twenty-first to the twenty-third mile, we passed over a low ridge timbered with poplar, spruce and willow, where the land was cold and wet.

The balance of the forty-five miles was through prairie and poplar copse, with a few willows in low places; the proportions were about one-third copse to two-thirds prairie, with grass twelve inches high, growing sufficiently close to form a sod.

The trail follows the more open parts of the country, and it is probable that the proportion of wood land at some distance to either side would be greater.

The soil, with the exceptions above mentioned, is a grey silt, with a few inches of vegetable mould.

About twelve miles from Dunvegan we came upon Ghost Creek, twelve feet wide, a branch of the Brulé River, which we crossed at about nineteen miles; the latter is fifty feet wide, and empties into the Peace fifteen miles to the east of Dunvegan.

At the thirty-ninth mile we crossed the Bad Heart River, sixty feet wide, in a valley 250 feet deep, a quarter of a mile wide in the bottom, and nearly half a mile wide at the level of the plateau. From where we crossed, it flows in a north-east course for about five miles, and empties into Smoky River.

See section $\frac{55}{118}$ for Dr. Dawson's description."

See also *Appendix, Pac. Ry. Rep*, 1879.

$\frac{55}{120}$ See Sec. $\frac{55}{118}$ for Dr. Dawson's description.

See also *Appendix, Pac. Ry. Rep.*, 1879.

$\frac{55}{121}$ *Cambie Exploration*, 1879.

Mr. Cambie entered this section at its north-western point, and travelled south-easterly towards Pine River.

### HUDSON'S HOPE TO PINE RIVER.

"We reached Hudson's Hope September 15th, and tried to obtain a guide to take us to Pine River, but failed, as the Indians were all absent; accordingly, we left next morning and followed a hunting trail to Moberly's Lake. This trail ascends from Peace River by a series of benches, and at one and a half miles reaches the plateau, which is there about 2,000 feet above sea level, and continues at the same elevation to the fifth mile; it then passes over a ridge 900 feet above the plateau and along a steep hill side to the south-western end of Moberly's Lake, at an estimated elevation of 2,050 feet above sea level.

In the first five miles from Hudson's Hope we had crossed two small tamarac swamps and some stretches of light, sandy soil, with a small growth of poplar and spruce.

We had again met with some level land in the valley of Moberly's River, which, for nine miles above the lake, averages nearly half a mile in width in the bottom. Some portions of this are gravelly and barren, and others fertile, with a few small prairies producing rich grass. There are also some fine prairies at the lake, on slopes facing the south.

Between Moberly's Lake and Pine River there is now a young growth of spruce, black pine and poplar, but the piles of fallen timber proved the existence not long ago of spruce forests of moderate size, and a few belts of that timber, 6 in. to 24 in. in diameter, having escaped the ravages of fire, are still standing."

See also *Appendix, Pac. Ry. Rep.*, 1879.

$\frac{55}{122}$ See Appendix Pacific Railway Report, 1879.

$\frac{54}{100}$ See Appendix Pacific Railway Report, 1879.

$\frac{54}{101}$ *O'Keeffe Exploration*, 1879.

Mr. Clarke passed through a small portion of the south-eastern part of this section on his way from Frog Portage to Cumberland House.

Just before entering this section Mr. Clarke passed out of the granite and entered at once upon Silurian limestone, which rises on all sides into cliffs 30 feet high; these are deeply pitted on the face. The bed of Sturgeon River is one solid mass of limestone. The country on each side of the river is low and flat. From this point to Cumberland House the country is nearly all swamp. At Cumberland House there is a farm of 8 to 10 acres, which produces good crops of various kinds. The soil consists of sandy loam and in places stiff clay. It is the only piece of good land in the neighborhood.

See also *Pac. Ry. Rep.*, 1879.

$\frac{54}{102}$ *O'Keeffe Exploration*, 1879.

Mr. Clarke passed through the north-eastern corner of this section on his way from Frog Portage to Cumberland House.

The north-west portion of this section consists chiefly of granite ridges with a scanty growth of aspen and birch, and in the valleys a poor coarse grass. About the centre of Beaver Lake the formation changes from granite or syenite to limestone.

In the south-west portion of this section are large marshes, one on each side of Swampy River, producing hay. Balsam poplar, tamarac and willow are found here.

See also *Pac. Ry. Rep.*, 1879.

$\frac{54}{103}$ *O'Keeffe Exploration*, 1879.

Mr. Clarke reports that "the north portion of this section is chiefly composed of sandy ridges, with marshy meadows close to Bear River. The east central portion is sterile, consisting of a thin covering of moss on rock, growing stunted poplar and birch. In the west central portion there is a good deal of marshy meadow, and the south-east portion is of the same character. Along the southern border is a tract of fair land."

$\frac{54}{104}$ *O'Keeffe Exploration*, 1879.

Mr. Clarke, in his excursion south of Lac La Ronge, examined the north-east corner of this section. Speaking of the northern part of this section, he says:

"The principal part of this section is occupied with lakes, large and small, and muskegs. In the north-west portion there are small sections of fair land south of Lac La Ronge and surrounding Egg Lake. Around the latter lake there is a belt of fine timber, consisting of tamarac, poplar and in places balsam.

Mr. O'Keeffe was informed by his guide McLean, that the east central portion is occupied with a range of sandy hills or mountains and a portion of Bear Lake. The south-eastern portion contains a quantity of marshy meadow and some good land, while to the south-west lies a large tract of muskeg. The timber of this part is small spruce and poplar."

$\frac{54}{105}$ *O'Keeffe Exploration*, 1879.

Mr. Clarke examined the north-western part of this section and entered its eastern side at Burnt Mountain Speaking of the whole of it, he says:

"The north half of this section consists entirely of lakes and muskegs, intersected with sandy ridges, the latter, for the most part, covered with small birch and poplar and occasional spruce.

Mr. O'Keeffe examined the southern half, and describes it as follows:—

Almost centrally situated in this section is the Montreal Mountain, the slopes and crest of which are composed of very good land, and produce small spruce and poplar.

The south half consists of good land and some lakes, and the south-eastern corner is almost wholly occupied by Montreal Lake."

$\frac{54}{106}$ *O'Keeffe Exploration*, 1879.

Mr. O'Kaeffe, P.L.S., entered the south-western corner of this section, travelling south-easterly.

The portion explored was "mainly very fair land with some lakes and rivers." The remainder of the section is thus described:—"The northern portion of this section consists of sterile sandy plains and a good deal of mossy muskeg, the timber consisting of stunted spruce, birch and poplar.

The central portion is occupied by lakes, and the Birch Hills, and has some good tracts of land. Soil sandy loam, changing to sand. The timber is of fair quality, often being a foot in diameter."

$\frac{54}{107}$ *O'Keeffe Exploration*, 1879.

Mr. Clarke passed due north through the centre of this section, on his way to Isle La Crosse Lake.

"The north-eastern and central portions of this section consist of good alluvial land in places along the Beaver River, but inland a short distance the land is sandy and sterile. The river banks are well wooded with spruce.

Mr. O'Keeffe describes the southern portion about Green Lake as being generally good land and well suited for agricultural purposes. Timber in the south-eastern part of this section is of very fair quality, consisting of spruce, poplar and tamarac."

See also *Pac. Ry. Rep.*, 1879.

$\frac{54}{108}$ *Eberts Exploration*, 1879.

Mr. Melchior Eberts travelled westerly through the southern portion of this section:—

"At the 126th mile again crossed the true forest limit, leaving it to the north. Muskeg continued for about six miles in this section up to the 130th mile, where a delightful change took place as we passed from the muskegs on to a beautiful rolling prairie, lightly timbered in spots with small poplar.

To the south, as far as could be seen, the country appeared the same. To the north, from four to six miles, the dark line of the forest is seen. The land through this is very good, black and sandy loams, and in the bottoms alluvium.

The surface is covered with most luxuriant grasses and vetches, oftentimes so matted and tangled that it was only by the greatest exertion one could push through them.

This part has good drainage. Numerous rapid streams, from 10 to 40 feet wide, with stony bottoms, were crossed, and judging from the purity of the water, were, evidently, outlets of lakes lying to the south; these all flowed north towards the Beaver River."

54
109 *Eberts Exploration*, 1879.

Travelling along the southern boundary of this section to about lon. 109° 30', thence struck north-westerly :—

"In the south-east corner of this section passed through a fine rolling country, sandy loam on the ridges and black loam in the bottoms; grass and pea vine very abundant. From the centre of the southern part, and running northward towards the Beaver River, is a range of high hills, principally of sandy soil mixed with gravel and boulders on the ridges.

In the bottom were meadows producing luxuriant grasses; on the hills, where lately burnt over, vetches and fireweed were very heavy, the inner fibre of the latter, when gathered in the proper season, makes a very strong rope, similar in appearance and equal to hemp."

Many large fishing lakes occur among these hills, around which the Indians have their vegetable gardens.

The timber is principally poplar and spruce. Travelling to the western side of this section the soil becomes poorer, grass thin and sickly-looking.

*Surveyor-General of Dominion Lands Report*, 1880—*G. A. Simpson D.L.S.*

Mr. George Simpson travelled north-westerly from Fort Pitt to Cold Lake, a distance of 90 miles. Speaking of the country north of Frog Lake, he says:

"For twenty miles the country is low and swampy; beyond that it is equal if not superior to any I saw in the Territory. The timber, poplar and fir, is of good size and stands in groves, the soil is clay loam with clay sub-soil; the grass was from two to three feet high and the water excellent.

I may state that, after passing Frog Lake, the water flows to the north, which makes the water-shed here at latitude 54°. Cold Lake, which has not yet been laid down on the map, is about twenty miles in diameter, and as near as I could make out from Chief Kinoosayoo, is pear-shaped, the stem lying toward the south.

To the north and west of Cold Lake, he informed me, is another lake called Goose Lake, about ten miles in diameter. Both these lakes have plenty of whitefish in them. Goose Lake is drained into Cold Lake, and Cold Lake is drained by a stream running a little south of east, emptying into Beaver River, near the H. B. Fort at Green Lake.

Beaver River, which runs about ten miles south of Cold Lake, is at the crossing, about one hundred and fifty yards in width, it has high steep banks, well timbered with large fir and poplar.

It is here that a band of Indians belonging to the Chippéwayan tribe have chosen their reservation.

I saw ploughing done by these Indians equal to what I have seen at some of the ploughing matches in Ontario.

They are noted for their industry; they have built two bridges over a large stream which empties into Beaver River, and have also built for themselves twelve timber houses.

They have thrown aside the blanket and wear clothes similar to the white man."

See also *Appendix Pac. Ry. Rep.*, 1879.

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**110** *Eberts Exploration*, 1879.

Entered this section at about lat. 54° 13', travelling north-westerly to Beaver River, thence south-westerly:—

"For 10 miles the land is of questionable value, principally sand; grass very light and small; muskegs more frequent. Lakes are numerous and well stocked with fish. Timber, in places, large, of balsam, poplar, spruce and, on the borders of swamps, tamarac. Thence, having passed the hills, entered on a level prairie, the country improving in richness of soil and pasturage. Struck a cart road at 133rd mile, and in five miles reached the crossing of Beaver River, which is here 130 feet wide, flowing from west to east through the centre of this section in a valley 1,500 feet wide and 100 feet below the general level of the prairie. Cold and Goose Lakes, the headquarters of the Chipweyan Indians, lie to the north.

At 248th mile reached Moose Creek, in a valley about 1,500 feet wide and 75 feet deep. With the exception of three narrow belts of sand, timbered with Banksian pine, the soil is good and vegetation rank. Thence travelling south-westerly to Moose Lake and along its eastern shores, passed some fine potato gardens (frost of 19th August had nipped the leaves of some but did no harm). Thence rounding the southern end of the lake, rose on to a plateau (by aneroid 1,690 feet above sea level), the highest ground yet found.

In the southern part of this section, through and along the Moose Hills, the soil is principally sand, supporting a fair growth of bunch grass, unfit for cultivation, though a very desirable summer range for cattle."

See also *Appendix, Pacific Railway Report*, 1879.

**54**
**111** *Eberts Exploration*, 1879

Mr. Eberts entered this section, from Moose Lake, about latitude 54° 20', and travelled north-west to Lac La Biche, and subsequently explored the northern portion.

"At 272nd mile, crossed the valley of Pheasant Hill Creek, 3,000 feet wide, and from 75 to 100 feet deep near the hill of that name, and passed over another beautiful stretch of country to the cart trail crossing of the Beaver River, 291st mile. The soil was rich and warm, and well adapted for settlement. Thence for six miles over a sandy ridge, covered with Banksian pine and small poplar, to Gull Lake. From this to Little Beaver River, 22 miles, was chiefly over ridges of black and sandy loams, dividing swamps, lakes and muskegs. Three miles from crossing of Little Beaver River is situated the farm of Mr. Prudhomme, whose crops of barley, wheat and oats had been entirely destroyed by frost on the 27th July, while the crops on the lake shore, 12 miles to the north, were uninjured. At Lac La Biche, the Hudson's Bay post is situated 320 miles from Carlton. On the south shore, farming is carried on successfully at the Roman Catholic Mission, and fine crops of grain were harvested in the latter part of August. Tobacco has also been raised for some years. The north shore is thickly timbered with spruce and poplar. For five miles north of the lake, up to the crossing of Owl River, the soil is good, but not well adapted for agriculture, being very broken and hilly. After crossing Owl River, and continuing north, passed nothing but sand hills and muskegs, with grass only on the borders of the lakes. Timber consists of Banksian pine, tamarac and spruce, the latter covered with moss." Mr. Eberts travelled from Hudson's Bay post, on Lac La Biche, north-easterly 25 miles to Heart Lake, passing over a high, rolling country of light, sandy soil, mixed with gravel and boulders, and timbered with spruce and poplar. At this lake the Indians had good vegetable gardens. Hence explored south of east as far as the Clear Water River, passing some large lakes well stocked with magnificent whitefish and salmon-trout. The soil on this part becomes lighter, and the country is very much cut up with swamps and muskegs; timber, poplar, spruce and tamarac. The Clear Water here is 100 feet wide and two feet deep, with quicksand bottom.

See also *Appendix. Pac. Ry. Rep.*, 1879.

$\frac{54}{112}$ See Appendix, Pac. Ry. Rep., 1879.

$\frac{54}{113}$ *Gordon Exploration*, 1879.

Mr. Gordon travelled south through this section from Athabasca Landing to Edmonton.

"Soon after we had reached the Landing the expected train of carts from Edmonton arrived, and after unloading their cargoes, returned. The country for some distance south of the Landing is broken into ridges, the soil being at first poor, but after twenty miles are passed it becomes very attractive, rich with luxuriant grass and pea vine, watered by frequent streams and lakelets, and occasionally dotted with aspen copse. Approaching Edmonton, and particularly from the crossing of Sturgeon River, the soil is exceptionally rich. The road leads for miles by luxuriant hay meadows, and through gently rolling wheat-lands of great fertility. Large fields of wheat had already been cut,—one field not far from Edmonton covering 100 acres,—and the hearts of the settlers were gladdened by an abundant harvest. We came unexpectedly on a little clump of houses overlooking the Saskatchewan, and a little lower down on the river bank we entered the centre of the settlement, Fort Edmonton, the most important Hudson Bay Company's post in the North-West Territories."

*McConnell Exploration*, 1879.

Mr. McConnell describes thus the vicinityof Athabasca Landing:

On either side of the trail in the vicinity of Athabasca Landing the country was almost all a dense growth of small poplar or muskeg, the soil consisting of sand and clay with a slight clothing of black mould. A Half-breed trader informed him that this description of land extended out to Lac la Biche.

See also *Appendix, Pac. Ry. Rep.*, 1879.

$\frac{54}{114}$ See Appendix, Pac. Ry. Rep., 1879.

$\frac{54}{115}$ See Appendix, Pac. Ry. Rep., 1879.

$\frac{54}{116}$ See Sec. $\frac{54}{117}$; also Appendix, Pac. Ry. Rep., 1879.

$\frac{54}{117}$ *Dawson Exploration*, 1879.

Dr. Dawson, proceeding south-easterly, traversed this section on his way from Pine Pass to the Athabasca.

"The largest tract of poor land is that bordering the valley of the Athabasca on the north. This rises to an elevation considerably greater than most of the region to the north and west.

This region is also very swampy in many places, and for a width of 20 to 25 miles on the trail from Sturgeon Lake to the Athabasca is quite unsuited to agriculture, though in many places capable of yielding good summer grazing where the forest has been completely removed by fires.

In the southern part of this section the country is quite elevated, and most of the tributaries of the Smoky River rise at a short distance from the Athabasca. The tributaries of the latter stream from the north being, with the exception of the Baptiste, quite inconsiderable in this part of its course.

The ridges and hills by which this region is occasionally diversified appear in all cases to be composed either of the generally soft rocks of the cretaceous and tertiary, or of arenaceous clays containing erratics and representing the boulder clays of the glacial period. These elevations are generally slight, and with exceedingly light and gradual slopes to the scarped banks of the streams constituting much more important inequalities.

$\frac{54}{118}$ For description of northern part of this section, see $\frac{54}{117}$.
See also *Appendix, Pac. Ry. Rep.*, 1879.

FROM THE 100TH TO THE 119TH MERIDIAN ANE BETWEEN THE 53RD AND 54TH PARALLELS OF LATITUDE.

$\frac{53}{100}$ *John Smith, M.D., Exploration*, 1879.

Mr. H. B. Smith, C.E., on his way from the mouth of Carrot River to Lake Winnipegosis, passed south-easterly and southerly through this section.

Of the country west of Cedar Lake, he says:—"It is reported that the muskeg over which this portage passes (he is speaking of Mossy or Cedar Portage, which is all muskeg), continues westward an indefinite distance. It is also reported that at Pine Bluff, on the River Saskatchewan, 45 miles below the Pas Mission, canoes can ascend Poplar River, be carried over a portage of two miles in length and placed in another stream which falls into Lake Winnipegosis at the extreme north-western point of Dawson's Bay."

See also *Appendix, Pac. Ry. Rep.*, 1879.

$\frac{53}{101}$ *Dr. Smith Exploration*, 1879.

Mr. H. B. Smith crossed this section, in his voyage down Carrot River, in a north-easterly direction.

"Except a narrow strip, seldom over 300 yards wide, on the river banks the country is totally unfit for settlement.

Carrot River, where it enters the Saskatchewan, is almost 200 feet wide with low flat banks."

See also *Appendix, Pac. Ry. Rep.*, 1879.

### $\frac{53}{102}$ *Dr. Smith Exploration*, 1879.

Mr. H. B. Smith, in his voyage down Carrot River, passed almost through the centre of this section in a north-easterly direction.

"Shortly after crossing the boundary of this section a mineral spring was passed, similar in taste and color to the Borthwick water at Ottawa. At this point also signs of a swampy country in the interior were apparent."

An Indian settlement was found at the foot of the rapids on a very pretty spot. "They have built nine substantial houses, and are busily engaged cutting hay, raising potatoes and fishing. A canoe route runs northward from this point to Cumberland, through a series of marshy lakes and creeks. From information obtained here the country on both sides of the river, excepting a narrow belt of half a mile in the vicinity of the river, is one mass of marsh and water, broken only at rare intervals by patches of good dry land."

About the middle of the section, at the Hudson Bay Company's post, the first view of the Pas Mountains was obtained. They appeared to the south about 18 miles off, rising boldly from the marshy plains to the height of 700 feet. "It is reported they are densely wooded with large spruce, poplar and tamarac. The summit is principally muskegs and small lakes."

"A branch of the Saskatchewan, 90 feet wide, enters Carrot River near the eastern border of the section, and from 20 miles above this point to it enters the "Great River," it is navigable for steamers of light draught. The river banks are alluvium, and are well timbered with elms, maples, poplars and spruce; outside of the river banks the country is marsh."

See $\frac{53}{104}$ for Mr. A. L. Russell's description.

See also *Appendix, Pac. Ry. Rep.*, 1879.

### $\frac{53}{103}$ *O'Keeffe Exploration*, 1879.

Mr. O'Keeffe entered this section a little north of the middle on its western side on an excursion from Candle Lake.

"Down the river for 15 to 20 miles the land on both sides of the river is good clay, black and sandy loam, clay and sand for subsoil. Land level on both sides of the river, which is about 60 feet wide, and from 2 to 2½ feet deep, stony and gravelly bottom; timber, poplar, spruce, birch and willow."

McLean and Anderson, his guides, reported that between the Saskatchewan and Sturgeon Rivers there was good land, particularly along the last-named river. A belt of sandy country extends between the two rivers, and on each side the land is good. To the north of Sturgeon River good land with marshy meadows and some muskegs, and numerous large lakes is the rule. On the sandy country along the Saskatchewan stunted Banksian pine is found, but north the timber is as above.

### *Dr. Smith Exploration*, 1879.

Mr. H. B. Smith, in his voyage down Carrot River, crossed the southern part of this section, travelling north-easterly.

A little west of the boundary of this section the river is only 4½ miles from the Saskatchewan.

Where the river enters this section the banks are of considerable height, but decrease much in altitude after the middle of the section is passed, and on the eastern side are only about 10 feet.

About the middle of the section many groves of fine timber, consisting of spruce, Banksian pine, poplar, birch, tamarac and maple, were seen often over

2½ feet in diameter, but much of the country was a brûlé. A little east of the middle of the section the first exposure of rock *in situ* is seen. "An exposure of limestone slate of a very soft nature was seen on the south side."

As far as seen the land seemed well suited for cultivation, and was covered with a continuous forest of the above-mentioned trees. As the eastern side of the section, however, was approached the forest became one of aspen poplar of small size, and the soil light and sandy. In passing through this tract the river bed is greatly encumbered "with very large boulders of limestone, granite and syenite."

The river constantly increased in width as he crossed from west to east, and before the rapids were reached averaged eight feet in depth.

See $\frac{53}{104}$ for Mr. A. L. Russell's description.

See also *Appendix, Pac. Ry. Rep.*, 1879.

$\frac{53}{104}$

### *O'Keeffe Exploration*, 1879.

Mr. O'Keeffe passed for a distance of 50 miles north through the centre of this section to Candle Lake, and thence north-westward to Great Bittern Lake, 30 miles; on his return from Candle Lake to Prince Albert he passed south-westerly a distance of 32 miles.

On the line from Fort à la Corne to Candle Lake the land varies very much in quality, but about the one-half of it is very fair land. "The land on the eastern half of this section to about half-way between the Saskatchewan and Sturgeon Rivers is sandy and poor. In the vicinity of Sturgeon River the land improves and is good for agricultural purposes." In the northern part of the section, west and east of the head of Candle Lake, there is some good land, also muskeg and some meadow marshes; numerous large lakes are scattered along the western side in the north. There is some very superior spruce and tamarac in this section, 18 to 24 inches in diameter, poplars of about the same size; plenty of white fish in the lakes and rivers. The country in general is gently rolling or almost level.

### *Dr. Smith Exploration*, 1879.

Dr. Smith entered this section about the centre of its southern boundary way from Swan River to Fort à la Corne.

The first 13 miles of this district may be classed as undulating prairie, with soil of the richest character. It is also well watered by two important streams, the Maple and Carrot Rivers. The Maple River, at the point of crossing, is 15 feet wide and two feet deep, with clay banks 10 feet high. The Carrot River, at point of crossing, is 25 feet wide and three feet deep, with clay banks seven feet high. From point of crossing for eight miles low rich land with numerous lakes until a ridge is reached 70 to 100 feet above the prairie level, this is sandy and covered with spruce. One mile of sandy soil of no agricultural value extends to the Fort.

Mr. H. B. Smith travelled easterly down Carrot River from the centre of the southern part of this section.

The land on both sides of the river is partially open and slightly undulating at the point of departure. The soil is of the richest possible character, being clay loam from one to three feet deep with a subsoil of clay. Clumps of small poplars may be seen in all directions. Three miles east from the point where the trail crosses the river, the timber commences and continues all the way down the river.

While crossing this section many exposures of the river bank were observed, which averaged from four to five feet of friable clay, beneath which lies a thick stratum of coarse gravel and sand. As far as could be observed from the top of banks, the surrounding country was rich and fertile and free from swamps and muskegs.

The river for the whole distance is rapid and tortuous, its breadth varies from 20 to 60 feet, and its depth in the rapids only a few inches. "The banks, which alternately show dense brûlés and green timber consisting of poplar, spruce and Banksian pine of 12 inches in diameter, average 30 feet high."

*Surveyor-General of Dominion Lands' Report*, 1880.—*A. L. Russell, D.L.S.*

Mr. Russell explored the Carrot River eastward through this section.

### DESCRIPTION OF CARROT RIVER.

"For about 80 miles in an air-line due east of LaCorne, the Carrot River runs through a fertile, well-wooded and well-watered country; but after reaching Shoal Lake Settlement, a perfect Indian paradise, abounding in fish, ducks, geese and some large game, the banks become lower, and a short distance in the rear thereof are extensive swamps, lagoons and lakelets, similar to the country adjoining the Saskatchewan River, between Cumberland House and the Grand Rapids.

Much large timber is to be seen, more especially in the lower part of the river, and consists of poplar, spruce, cottonwood, maple, elm, &c. From Indian reports the woods extend back a long distance from the river.

While on the subject of timber, I may remark that the Birch Hills, south of La Corne, contain much large poplar. Down the northern slope of these hills flow several small streams, the largest of which is called Sugar or Stony Creek, and on its course are several valuable mill sites. Several mill sites are also to be found on the Carrot River, as well as on Pine Creek, a small stream emptying into the Saskatchewan River near "The Forks."

A steamboat, similar to those used on the Saskatchewan River, could ascend readily all summer the Carrot River from the Pas Mission, for 76 miles (56 in an air-line) to where an important feeder, 60 feet wide, comes in from the north. Throughout this distance the river averages 200 feet in width, and has a current of from one to one and a-half miles an hour.

From the above point upwards the river is choked in many places with driftwood, and 12 miles (air-line) further on there is a very serious barrier of rapids with a fall of over 20 feet in two miles.

About 50 miles (41 air-line) up from the main Saskatchewan River there comes in from the north-west a channel of the Saskatchewan, known as the Supanagoose, 90 feet wide, which diverges from the main stream about 30 miles (air-line) south-west of Cumberland House. The Carrot River proper, therefore, terminates where it meets the Supanagoose, and the two channels form a large island, about sixty-five miles long, south of Cumberland House."

See also *Appendix, Pac. Ry. Rep.*, 1879.

$\frac{53}{105}$ *O'Keeffe Exploration*, 1879.

Mr. O'Keeffe travelled in almost every direction through this section, and describes it generally north of the Saskatchewan for the whole breadth of this section; "The land is suited for agricultural purposes as far north as Little Bittern Lake on the east, and thence diagonally north-west to Red Deer Lake. North of Little Bittern Lake there is a large marsh or swamp which lies between the above lake and Great Bittern Lake to the north-east.

Along the northern boundary of the section, the land is good and extends northward to the top of Montreal Mountain (see $\frac{54}{105}$).

About 6 miles north of Prince Albert, a series of sand hills and ridges from 3 to 5 miles wide, extend easterly through this section into the next (see $\frac{53}{104}$). This tract of country, although principally quite sandy, contains many small tracts of very good land. The prevailing timber here is Banksian pine, but much good aspen poplar is likewise seen.

With the exception of this strip of sandy country, all the other has a first-class soil of a mixed character, passing from rich black clay loam with or without small pebbles and gritty sand into all varieties of loam till it passes into sand in the ridges spoken of above.

North of the sand ridges are large quantities of very fine timber, consisting of spruce, poplar and tamarac. Passing still further north, the country gradually becomes better until it assumes a swampy character in the neighborhood of Bittern Lake. In the south-eastern part, north of the rivers, are many pine prairies, interspersed with groves of aspen poplar.

On the western margin of the centre of this section, Mr. O'Keeffe found a small area under crop on the eastern side of Sturgeon Lake, lat. 53° 30′. Wheat, potatoes and barley were under cultivation, the former and the latter being fit for harvesting (22nd Aug.) and most promising."

The potatoes could not be excelled for size or quality anywhere.

See also *Appendix, Pacific Railway Report*, 1879.

### *Marcus Smith Exploration*, 1879.

Mr. Marcus Smith, M.I.C.E., travelled eastward from Fort Carlton to Fort à la Corne through the southern portion of this section.

"Immediately beyond this the soil improves, and scattered homesteads appear; at about 30 miles the trail crosses the Red Deer Creek; the soil beyond this increases in richness and the homesteads are more numerous. The main settlement is on a flat nearly opposite Sturgeon River. Farm homesteads, at intervals, extend down the banks of the north branch of the river to the Forks, and there is a settlement on the south branch, principally half-breeds.

The soil is a rich, light loam, which produces crops of wheat averaging 30 bushels to the acre. There are occasional low, level flats on the margin of the river; further inland the land raises fully 200 feet above the level of the river; it is rather lumpy and rough, broken with numerous ponds and lakelets fringed with aspen and willows.

These high lands cost more labor to get them under cultivation; but I was informed they produce better crops than the low flats. On the uncultivated lands the natural crops of grass, wild peas and vetches were so heavy that if we left the trail we found great difficulty in forcing our way through.

About 18 miles above the Forks the peninsula is crossed by another sand-belt about 4 miles wide, covered with jack pine. On the point there are two homesteads on which there were good crops of wheat nearly ripe and good kitchen gardens.

From the Forks down to Fort à la Corne we found the soil rather sandy in some places near the river, but further back it is fully equal, if not superior, to Prince Albert. On the Paonan Creek there several farm homesteads taken up.

See also *Appendix, Pacific Railway Report*, 1879.

$\frac{53}{106}$

### *O'Keeffe Exploration*, 1879.

Mr. O'Keeffe travelled through this section in every direction, and describes it generally:—

"The southern part of the section is almost all prairie with a few alkaline marshes in the western corner. Passing north on the trail to Sandy Lake Mission the land constantly improves, and at the Mission the soil is very rich indeed. On the trail from Carlton to Sturgeon Lake the land is also very good.

The valleys of Shell and Big rivers are very rich, and the whole land enclosed between those rivers partake largely of the same character. This tract is mixed prairie and forest and is generally level. Sturgeon River, discharging Stony Lake, runs south-easterly through the northern half of the section. The land throughout its whole course to the Indian Reserve, on both sides of the river, is first-class, though there are a few muskegs and swamps scattered through it.

No finer country could be desired than the section above described. The water is pure and abundant and the land extremely rich. Pea vine, vetches, grasses, and, in fact, all herbaceous plants were luxuriant, but this statement applies also to burnt districts. Very fine fish are in all the rivers and lakes of the section; the whitefish being extremely abundant, large and of fine quality. The timber on this section is not so good as that either east or west of it, but many groves of fine timber were observed scattered through it.

In the north-western part of it the land is very good but the timber is not of large size, being nearly all second growth as the old timber had been burnt down by fire some years ago. The whole section may be classed as level plain or gently rolling land, no hill being seen higher than 50 feet except in the vicinity of the Mission.

The land generally in the vicinity of Sandy Lake Mission is a rich loam, containing a small percentage of gravel, which, indeed, is the prevailing character of land for many miles.

At the Mission, saw a small field or two of the best spring wheat I have ever seen, which would be fit to harvest in ten days (August 20th)."

*Eberts Exploration*, 1879.

Mr. Eberts, travelling north-westerly from Fort Carlton towards Pelican Lake, passed over the south-western portion of this section:—

"From lat. 53° to Shell River the country is principally prairie, lightly timbered in places with small poplar, exceedingly rich and fertile, consisting of sand and clay loams. A great many hay meadows and small lakes are met with, several of the latter being slightly alkaline.

At Sandy Lake the Indians, under the supervision of Mr. Hinds, Church of England Missionary, were cultivating successfully fine fields of grain and raising vegetables. To the west of Shell River, in the hills, the soil is principally sand with a mixture of gravel and boulders. Wherever the timber was burnt off the surface was covered with a thick growth of grass and vetches.

Shell River valley is about two miles wide. This stream joins the Sturgeon River, which empties into the Saskatchewan.

On the 14th October, snow fell to a depth of 14 inches, but disappeared in a week.

The snow-fall during the winter does not exceed two feet; horses winter out, and when taken up in the spring are in good order. Winter sets in about the 1st November and remains steadily cold until April."

See also *Appendix, Pacific Railway Report*, 1879.

$\frac{53}{107}$ *O'Keeffe Report*, 1879.

Mr. O'Keeffe entered this section on his way north-westerly from Sandy Lake Mission to Stinking and Pelican Lakes.

"The land from the Mission westward to Stinking Lake is generally very good, but somewhat broken by the creek valley, which forms the head of Shell

River, continuing along Stinking Lake at the north end, we crossed Big River, a stream about 100 feet wide, and discharging the waters of the above lake. From here to Pelican Lake the land is generally good, with a soil varying from black clay loam to sandy loam, subsoil generally clay or sand. On this line there is a good belt of spruce and tamarac. Continued our course along the east and north sides of Pelican Lake, through spruce and tamarac woods of fine timber averaging 20 inches in diameter, and from 50 to 60 feet high, which continued for two and a half miles, then poplar with birch, spruce and tamarac prevailed.

A fine stream 60 feet wide. and four to five feet deep, flows out of the lake, and runs to the north-westward to Beaver River.

Extending eastward from Pelican Lake to nearly the eastern side of this section, a tract of very poor sandy land is found. To the north of Clear Lake, it extends for six miles, and southward to an undefined distance."

*Eberts Exploration*, 1879.

Mr. Eberts entered this section about latitude 53° 25', and travelled north-westerly to the north of Whitefish and Pelican lakes to its north-west angle.

"The country between Shell and Big rivers is the "divide" between the Saskatchewan and Beaver Rivers. "At the 58th mile from Carlton, crossed Big River, the outlet of Stinking Lake in this section. Rising immediately out of the valley to 150 feet, the country to the 67th mile is very rough and hilly, with numerous pot-holes, ponds, lakes and swamps in all directions, the soil becoming light in proceeding north. At the 67th mile, latitude 53° 40', entered a forest which is 13 miles across. This is the southern limit of the true forest. The timber is large, consisting of spruce, balsam, poplar, Banksian pine, and a few trees of yellow pine from 12 to 30 inches in diameter, but at present is of little use for economic purposes, as it lies too far north of the Saskatchewan water-shed. Through the forest the soil improves, clay being mixed with the sand.

From the 80th mile to Pelican Lake, the land again becomes worthless,—sand ridges, hills and muskegs. Some fine lakes were passed, affording a fair supply of fish.

On the shores of Pelican and Whitefish lakes, which are the largest in this section, the Indians in favored spots grow vegetables.

At the 100th mile, on the 26th July, crossed Pelican River. It was swollen, and rapid from the recent heavy rains. Hence to the north-west corner of this section, a distance of about 20 miles, was the most difficult part of the country seen, being one vast muskeg, with here and there a sand island, or a ridge lying north and south thickly covered with small spruce and poplar. The soil is a fine white silt, and worthless. Numerous streams were met with from 10 to 40 feet in width, the crossing of which was dangerous and difficult."

On his return journey, Mr. Eberts travelled easterly through this section at about latitude 53° 23', passing south of Stinking Lake.

"Leaving Birch Lake, and approaching the Thickwood Hills, the country becomes hilly and uneven, soil poor, though strong enough to support luxuriant grasses. On the south side of Stinking Lake is a large meadow which extends for the whole length of the lake, and for some miles to the south.

After leaving this lake, crossed over a low ridge to the head waters of Shell River. The course was continued through the valley of the river, which continued to increase in width."

See also *Appendix Pac. Ry. Rep.*, 1879.

$\frac{53}{108}$ *Eberts Exploration*, 1879.

Mr. Eberts entered this section about lat. 53° 36', travelling easterly, passing Turtle, Stony and Birch lakes, and describes the county as becoming more level; soil changing to black and sandy loams. In the neighborhood of the lakes the soil is very rich and of great depth. At Turtle Lake a small quantity of barley was sown last spring and harvested successfully, vegetables are also raised and, with the quantities of white fish to be found in the lakes, the Indians are in no fear of starvation.

See also *Appendix, Pac. Ry. Rep.*, 1879.

$\frac{53}{109}$ *Eberts' Exploration*, 1879.

Mr. Eberts on his return journey struck the Red Dear River, 11 miles east of Fort Pitt, travelling from thence almost due east for 20 miles over a rolling prairie, lightly wooded with spruce and poplar. The ridges of a light sandy loam and rocky, bearing a grass resembling bunch grass.

*Surveyor-General of Dominion Lands Report*, 1880—*G. A. Simpson, D.L.S.*

Mr. George Simpson travelled from Battleford to Fort Pitt north-westerly. Leaving Battleford he says:

"For about 20 miles the trail from Battleford to Fort Pitt passes over a light sandy loam, the timber is small poplar standing in groves, and the water generally has a brackish taste. After that for 30 miles the soil is somewhat better, then the trail passes through sand hills for two miles; soil worthless and timber small. From the sand hills to Fort Pitt, a distance of about 30 miles, the soil is light, but will, I think, produce good crops. This is the best section of country lying between Battleford and Fort Pitt."

*Surveyor-General of Dominion Lands' Report*, 1880—*W. F. King, D.T.S.*

Mr. King, who travelled through this territory, thus speaks generally of the land west of the 109th Meridian and south of Beaver River:

"The country through which I passed last summer has been so often described that it is needless for me to speak of it here. The country lying between Fort Pitt and Fort Edmonton, along the Fourteenth Base Line, will be described by Mr. Aldous. It is sufficient to say that, in my opinion, the tract of country extending from some distance north of Beaver River southward nearly to the telegraph line, west of the 109th Meridian, is not to be surpassed by any part of the North-West Territory, visited by me, for fertility of soil and adaptability for settlement. But, some distance north of Beaver River, we get into a country abounding in muskegs, and there, I think, summer frosts will be a serious obstacle to settlement, except in the vicinity of the large lakes such as Lac la Biche, Cold Lake, &c.

At Lac la Biche and at Whitefish Lake (which is between Lac la Biche and Victoria) there are large settlements. At the former place there is a Roman Catholic and at the latter a Wesleyan Mission."

See Sec. $\frac{54}{109}$ for Mr. Simpson's description of northern part.

See also *Appendix Pac. Ry. Rep.*, 1879.

**53**
**110** *Surveyor-General of Dominion Lands Report*, 1880—*M. Aldous, D.T.S.*

Mr. Aldous crossed this section from east to west on the 14th Base, latitude 53°. 35′. 52″.

"For the first six miles westward from the 110th Meridian, the country is rough and hilly, and covered with poplar bluffs, the soil being somewhat light and sandy. Across ranges two, three and four, is a magnificent stretch of country of the richest agricultural character; it is level and entirely free from ponds, and shows indications of having, in the near past, been covered with timber; at present, it is generally covered with scattered low willow and poplar; through the centre of it flows the Vermilion River, a fine stream of excellent water. The vegetation is very luxuriant, wild pea-vine and vetches having a remarkable growth.

At range five we strike a rough and hilly section of country, which continues across ranges five and six; in places it is thickly timbered, but may generally be called a bluffy country."

See Appendix Pac. Ry. Rep., 1879.

**53**
**111** *Surveyor-General of Dominion Lands' Report*, 1880—*M. Aldous, D.T.S.*

Mr. Aldous crossed this section from east to west on the 14th Base latitude 53°. 35′. 52″.

"Across ranges seven, eight and nine, and up to the second crossing of the Vermilion River, in range ten, the country is undulating, continuing bluffy, and in some parts well timbered with poplar; throughout, even to the hill-tops, the soil was found to be excellent, nothing being exposed in building the mounds but rich, black loam. Several small streams of good water run through this section.

In range 10, after crossing the Vermilion River, the country is more thickly covered with bluffs of poplar, the ground gradually rising from the river for several miles, soil continuing of the same excellent character. Running across range 11 there is a dense forest of poplar, with numerous ponds and muskegs. Range 12 is more open, but is hilly and broken with lakes and small ponds. Across range 13 is a very rough country, chains of lakes lying between a succession of ridges, together with numerous muskegs, being the principal features; it is all pretty well covered with poplar and willow, together with much dry timber and windfall."

See Appendix Pac. Ry. Rep., 1879.

**53**
**112** *Macoun Exploration*, 1879.

Prof. J. Macoun, F.L.S., on his journey from Hay Lakes to Battleford, crossed the south-west portion of this section, and describes it as good level arable land, much of it covered with willows and small poplars. Small lakes, ponds, and grass marshes were numerous. The soil generally was a heavy dark colored clay loam, and only in one spot was an admixture of sand seen. Land nearly level and water first-class, but it constantly got drier as they travelled easterly. Continuing a south-east course and keeping the willow thickets and poplar bluffs to the left, the country passed over had at one time been forest, but now there was hardly a large tree left. Dried Meat Hill, a rounded eminence standing alone, is not more than 50 feet high, covered with wood on the north side but quite bare on the south. The surrounding country is a most beautiful level plain with a gentle slope towards Battle River.

*Surveyor General of Dominion Lands' Report*, 1880—*M. Aldons, D.T.S.*

Mr. Aldous crossed this section from east to west on the 14th Base, about Latitude 53°. 35'. 52".

"After crossing the Vermilion River for the third time, in the first mile in Range 12, the country suddenly changes; here we have a fine level, partially wooded section, which continues to the Beaver Hills, a distance of thirty miles. This is a section of country particularly well adapted for settlement; the soil is good. To the north of Beaver Lake there are extensive hay meadows, and the Beaver Hills contain an abundance of excellent poplar, spruce, tamarac and some birch timber. The 14th Base Line passes about four miles to the north of Beaver Lake; this lake, I am informed, is about 15 miles in length, by 10 in breadth, the water being of good quality, and containing several kinds of fish.

Running north on the meridian, between ranges 18 and 19, the country is comparatively open and level as far as Beaver Creek, north of which the ground gradually rises to the north-east, and is more thickly wooded."

See also *Appendix*, *Pac. Ry. Rep.*, 1879.

53
113 *Macoun Exploration*, 1879.

The south-eastern portion of this section is described as a country of wonderful fertility, but very much broken by ponds, lakes and marshes. The soil throughout is the usual black loam on the surface, and occasionally more sandy. Willow thickets and poplar copse covered the country almost continuously. The abundance of fresh water was a very marked feature, and that this was increasing was evident from the dead trees standing around the margins of the larger ponds. Even Bittern Lake, which has all the features of a salt lake, was fresh, and the trees along the southern end were dead. On the banks of this lake, iron-stone nodules were observed. The soil in the neighborhood of the Hay Lakes was a black loam inclining to clay, about 15 inches deep, and resting on a clay sub soil mixed with gravel. Mr. McKernan has commenced to farm here. Near the telegraph station he has a small patch of potatoes of two varieties, one of white, the other of purple; found a sample of the former to measure 17½ inches in circumference. All the crops, consisting of barley, wheat and oats, were very fine. Mr. McKernan had sunk a well near his house and obtained bad water. He showed some crystals of selenite, which indicated that he had sunk into the Cretaceous clay. It was suggested that he should sink another one close by, but on no account to go down to the clay. He did so, and obtained excellent water.

*Surveyor General of Dominion Lands Report*, 1880.—*M. Aldous, D.T.S.*

Mr. Aldous crossed this section from east to west in the 14th Correction Line about Latitude 53°. 46'. 29".

"Westward, along the 14th Correction Line, the country is all of a similar character, soil excellent, and for the most part covered with large willow and scattered poplar. As we approach the Saskatchewan River there are a few groves of good spruce and tamarac. Where the line crosses the north end of Beaver Hills, the rise is hardly noticeable, the hills appearing to terminate in about this latitude. The country lying between the Sturgeon River and the Saskatchewan is of the finest agricultural character, and is rapidly being "taken up" by settlers.

Bordering Big Lake, to the south and east, there is much heavy spruce and poplar bush. From Big Lake to the 114th meridian, the ground gradually rises and is rough and broken, with swamps and muskegs, the soil being, for the most part, light and of comparatively inferior quality.

In the whole distance surveyed between the 110th and 114th meridians, we have not passed over a single mile of what I deem worthless land; there are belts, as already mentioned, of particular fertility, but even that which I have not classed in this way might be cultivated to advantage.

The streams throughout contain clear, good water, and but very few of the lakes or ponds are alkaline.

The latter part of the season has been particularly fine and favorable for surveying operations. At the time of writing (27th Nov.) there is not sufficient snow to cover the ground. The greatest degree of cold has been 9° below zero. On the 11th November the river froze over and Indians crossed on foot."

See also *Appendix, Pac. Ry. Rep.*, 1879.

53/114 See Appendix, Pac. Ry. Rep., 1879.

53/115 See Appendix, Pac. Ry. Rep., 1879.

53/116 See Appendix, Pac. Ry. Rep., 1879.

53/117 See Appendix, Pac. Ry. Rep., 1879.

53/118 See Appendix, Pac. Ry. Rep., 1879.

## FROM THE 100TH TO 119TH MERIDIAN AND BETWEEN THE 52ND AND 53RD PARALLELS OF LATITUDE.

52/100 *Dr. Smith Exploration*, 1879.

Mr. H. B. Smith, on his way from Lake Winnipegosis to Fort Pelly, passed south-westerly through the western portion of this section.

"On Gravel Point, a low, flat promontory at the head of Dawson Bay, on the eastern side, a French settler named Laronde has located himself and family. He reports the soil in his neighborhood where it is dry as being extremely fertile, but that a great deal of swamp existed.

"The eastern shore of the bay is low and flat, and is densely timbered with poplar and spruce. Wherever a landing was made, much marsh was observed in the interior."

Shoal River, which discharges Swan Lake, is about 200 feet wide, very shallow and full of boulders. Swan Lake is about 14 miles by 5, and extremely shallow and full of islands. "The shores of both lake and river are low and marshy but well timbered." The soil carried down by the Swan River from the higher levels has been deposited at its entrance into the lake, and thus a promontory of nearly 3 miles long has gradually been formed. From the Indian village to the "Store," a distance of 18 miles, along the banks of Swan River, is hard, dry land of a sandy nature, timbered with small poplars and spruce. Back from the river the country is very swampy,

See also *Appendix, Pac. Ry. Rep.*, 1879.

52
101 *Dr. Smith Exploration*, 1879.

Dr. Smith traversed the southern border of this section on his way from the telegraph line to the second crossing of Swan River.

The Indian reserve a few miles west of Northcote and west of Swan River, occupies a considerable portion of this region; there is in it excellent farming land. Agriculture has been, to some extent, engaged in by the Chief Keasikongs, and some good buildings have been erected, and a few small fields fairly well fenced and cultivated. A large portion of the reserve, however, is very wet, but might easily be drained.

Careful exploration of the country north of the reserve for 12 miles revealed a magnificent district—land excellent, and much large poplar, 24 to 30 inches in diameter. This was the character of all the region from the junction of the Thunder River with Woody River and far northward, while southward there was a stretch of rich but wet land extending to Swan River.

Westward of the reserve the soil was excellent, and the country heavily wooded with very fine timber, poplar, spruce and tamarac. A very large proportion of the land was wet and much cut up by small streams which had their sources in Porcupine Mountain.

Dr. Smith was informed that the Porcupine Mountain filled the greater part of this section, and was densely wooded throughout its whole extent. "Around the south-east end a shaking bog extends for many miles."

A severe frost occurred about the centre in lat. °52·07' on the night of July 27th or 28th, 1879.

Mr. H. B. Smith, on his way from Swan Lake to Pelly, passed across the south-eastern corner of this section for 20 miles.

It is partially open prairie, and very level. The soil is similar to the rich black mould of Manitoba. Several Indians have established themselves in this district. Land of similar character to the above is said to extend up to the Porcupine Mountain.

See also *Appendix, Pac. Ry. Rep.*, 1879.

52
102 *Dr. Smith Exploration*, 1879.

Dr. Smith passed north-westerly through this section on his way from Swan River to Carrot River. The six miles between the eastern boundary of this section and Swan River is very fair land with an excellent soil, but in many places very wet.

The valley of Swan River at the crossing is two miles from one summit to the other. The river lies in the middle 290 feet below. It is very serpentine, and 40 feet wide by 4 in depth.

From Swan River to camp 15, a distance of 11 miles, may be best described by the term marsh. A few dry islands of small poplar and willows are scattered through it, but the prevailing characteristic is swamp and muskeg, and shaking bog.

The next 11½ miles is described as marsh and muskeg, in the vicinity of the line, thinly timbered with small poplar, spruce and alders.

Westward of North Etoimami Lake to the western limit of this section, at Big Valley Creek many small streams were crossed, but the land where dry was very good. Generally heavily timbered with aspen, poplar and spruce. Soil principally light loam with a few swamps and muskegs.

See also *Appendix, Pac. Ry. Rep.* 1879.

52

103 *Dr. Smith Exploration*, 1879.

Dr. Smith, on his way from Swan River, entered this section about the middle and crossed it diagonally on his way to Fort à la Corne. Direction, north-westerly. From the time he entered the section until he reached Green Lake about its centre the land is described as exceedingly rich. The greater part had been lately burned over, and was now growing up with young poplar, hazel, cranberry and raspberry bushes. The fruit of the latter was fully ripe, very large and delicious. Grass and pea vine were thick and tall, and in the vicinity of the lakes the former spread out into meadows of vast extent.

Numerous outcrops of limestone were noticed in the stream beds, which will doubtless be of much value in the future. For five miles north-west of Green Lake the country is very hilly and sandy, with many boulders in the soil.

At the crossing of Red Deer River, Yellow Quill's band have located themselves, and here for one mile east of the river the soil is excellent.

North-westward from the crossing of Red Deer River to Birch Knoll, an isolated hill about 70 feet high, and about six miles from the river, the country is level, but quite sandy. Many small tracts covered with blueberries were observed here. After crossing Beaver River the land improved, and much fine land was seen extending westward as far as the eye could reach.

See also *Appendix, Pac. Ry. Rep.*, 1879.

52

104 *Dr. Smith Exploration*, 1879.

Dr. Smith passed through the north-western corner of this section northwesterly, on his way from Swan River to Fort à la Corne.

The whole distance across this section shows excellent land, fit for all agricultural purposes. The soil is a rich black loam of great depth, with a clay subsoil. It may be considered partially open prairie, as the timber is scattered in clumps over its surface. Aspen poplar 6 to 12 inches in diameter is frequent. Small lakes are numerous, and a few alkaline ponds were seen. The level of the country is generally uniform, though in some places broken by long coulées.

*Surveyor-General of Dominion Lands' Report*, 1880—*A. L. Russell, D.L.S.*

Mr. Alexander Russell ran a line north from the 10th Base north of Quill Lakes.

"As before stated, the meridian of Big Quill Lake, north of the 10th Base, runs through a swampy region thickly timbered with small poplar." At this point thick and impassable swamps were encountered, which stretched northward for some distance towards the centre of this section. "To the south-eastward from Little Quill Lake to Keespitanow Hill, the trail passed through a similarly good country."

Of the north-western corner of this section he says: "North-east and east of Waternen Lake claims have been located, and a number of log houses built and other improvements made by the settlers, who appeared well pleased with the season's crops and the future prospects."

### *Marcus Smith Exploration*, 1879.

Mr. M. Smith passed through the southern part of this section, proceeding easterly from Humboldt to Fort Pelly.

"Between Humboldt and the Quill Lakes the country is variable in some places, low and swampy where there is much willow brush, but eastward of this point where the trail crosses the telegraph line there are several miles of a beautiful park-like country, the trail wandering in open glades through groves of aspen. Before reaching Big Quill Lake we came upon an open alkaline plain extending northward to the telegraph line; this continues eastward nearly to Fishing Lake, and probably also to some considerable distance north of these lakes."

See also *Appendix, Pac. Ry. Report*, 1879.

52
105

### *Marcus Smith Exploration*, 1879.

Mr. Smith travelled southerly through this section on his way from Fort à la Corne to Humboldt.

"August 16th.—We travelled southward from Fort à la Corne to Root River and up the banks of the latter to its outlet from Water Hen Lake. Here we found several fields of wheat with very heavy crops nearly ripe, and two farm homesteads. I examined the well at one of them and found a depth of six feet of black mould on the top, with 16 feet of stiff clay loam to the bottom of the well. Mr. Robinson, the proprietor, informed me that this summer there were 14 farms selected, and a number of settlers were coming in next spring.

We started from the lake on a course 30° east bearing for Little Quill Lake, and reached the summit of the range without difficulty, about 19 miles from the lake, in which the rise is less than 200 feet. The surface of the ground is very uniform, the soil of the richest quality and several feet in depth, it is equal to the best parts of Manitoba, chiefly prairie with scattered clumps of poplar and willow till near the summit of the ridge, which is nearly all covered with a forest of poplar.

On the southern slope we met with so much fallen timber where the woods had been burnt, that we had to turn back, not having sufficient force to cut a way through for the carts.

We went due west along the northern slope of the Pasquia range till we struck a great marsh in the form of an L, the length of the arms being about 10 miles each, and three to four miles broad. Water Hen Lake is on the north arm and the outlet, Root River, is at the angle; it is about 20 feet wide. We followed up the stream which flows into the north arm, it rises to the south of the range and flows through a depression south of Minitchinass Hill. The ascent through the pass is very easy but the sides are rather rough, covered with brush and indented with lakelets.

The country between Minitchinass and Humboldt Station is lumpy and broken with ponds and lakelets of alkaline water, the soil is generally poor and continues so westward to the bend of the North Saskatchewan.

*Surveyor-General of Dominion Lands' Report*, 1880—*A. L. Russell, D.L.S.*

Mr. Russell ran the 12th Base (Lat. 52°. 53'. 27".) from the 106th Meridian eastward across the northern part of this section.

"Along the 12th Base line eastward from the 3rd Principal Meridian for 70 miles, the land is nearly all of very great fertility, and well wooded and watered.

See also *Appendix, Pac. Ry. Rep.*, 1879.

52
106 *O'Keeffe Exploration*, 1879.

Mr. O'Keeffe passed through the centre of the northern part on his way from Carlton to Sandy Lake Mission.

The land being generally prairie was rolling in places, with occasional clumps of small willows and alkaline lakes and marshes. Near the river the land was not so good but improved as he went north.

*Marcus Smith Exploration*, 1879.

Mr. M. Smith travelled down the South Saskatchewan from near the Moose Woods to the Ferry, and thence to Carlton and Prince Albert.

"We followed the right bank of the river northward to the Carlton cart trail. The soil is poor, and for some three or four miles back from the river it is thickly strewed with boulders, forming mounds and long, low ridges, closely packed.

Between the Ferry and Fort Carlton there are several squatters, settled since I passed in 1877, and quite a village at Duck Lake, clustered around the trading establishment of Messrs. Stobart, Eden & Co. This firm has under cultivation a considerable quantity of land, and we saw a fine field of wheat beginning to ripen when we passed it, on 8th August.

Near Fort Carlton the soil is rather light; thence on the trail to Prince Albert, for the first 18 miles, we passed over a pleasant, slightly rolling country of prairie, interspersed with groves of poplar. Soil, variable, but generally a light loam. We then crossed a sand belt four miles wide, covered with jack pine and a few princess pine. It is said the grasshoppers have never crossed this belt."

See also *Appendix, Pac. Ry. Rep.*, 1879.

52
107 *Macoun Exploration*, 1879.

Mr. Macoun entered this section about longitude 107° 40', travelling north-westerly towards Battleford.

"To the north of Bear Hills passed a large lake about five miles long, believed to be saline. Thence, for three miles, over a boggy plain, in which were found many springs of good water, and a small stream flowing eastward into the large lake. After passing this plain, another range of hills, in the centre of which found a large salt lake. Nearly all the land is good, but altogether without wood. In all the valleys the grass was of sufficient length for mowing, and excellent fresh water was found everywhere. Passing through these hills, came into a very broken country, with many rounded eminences covered with boulders, and deep depressions filled with pure water. The soil changed frequently, and at times was sandy with a gravel sub-soil, but the grass was always good. After passing the 10th Base Line the soil became very poor for a mile or two, but this soon changed, and the country, though broken and containing many boulders, was very rich. As a stock-raising region, the land seen yesterday and to-day, 27th July, could not be excelled, as it contains excellent water, a diversity of soil and good shelter in the valleys. Owing to the variable soil, its flora was correspondingly diversified. The grasses of the forest were on the hills, while those of the prairie were in the valleys. Wood was seen to the right of the course, about three miles off."

See also *Appendix, Pac. Ry. Rep.*, 1879.

52
108 *Macoun Exploration*, 1879.

Macoun entered this section about lat. 52° 18', travelling north-westerly towards Battleford.

"The country is very much broken with ridges, lakes and ponds, with boulders, as usual, on the hill tops. Soil of the valleys and slopes very rich and grass generally good. Many forest flowers were seen on the prairie. Thence entering the woods which had been previously seen to the right, passed for many miles through groves of poplar and along the margin of numerous lakelets and swamps with glades covered with the finest pasturage. The forest land is first-class but much broken and wet. Proceeding, a small percentage of sand entered into the soil and this increased so much in a few miles that the soil changed to a light sandy loam, with considerably less wood. A few miles further to the north, through a dry, hilly country, and the northern edge of the Eagle Hills was reached, overlooking a wide valley and plain. On the verge of the horizon, three or four white houses could be seen, this was Batfleford.

Approaching Battleford, the land became more and more sandy, until within half a mile of the Governor's house, were sand dunes, covered, however, with grass and trailing juniper, and the hollows filled with small poplars and brush wood; to the south of the hills lay the usual accompaniment of salt ponds. Descending 200 feet, to the level of Battleford, we passed through the straggling street and camped at its further end near the telegraph station.

Battleford, 30th July.—The police farm, situated on the point of land between Battle River and the Saskatchewan, is a sandy alluvium and appears to be very dry and barren, but it certainly has produced good crops this year. Three months ago it was barren prairie, now oats, barley, potatoes and turnips are growing luxuriantly. In the garden, also broken up this spring, are cabbages, cauliflowers and other vegetables of the finest description. Timothy and clover had been sown to form a grass plot, and these were now in flower and gave promise of producing abundance of seed. The Governor's farm, situated on the sand hills to the east of his residence, was also visited. Here the soil, outside the fence, was covered with the short prairie sward indicative of dryness, and which would have been pronounced as unfit for cultivation by most people, yet, within the fence were excellent oats, middling barley, short in the ear, but grain fine, and first-class wheat, the latter standing thick on the ground, nearly five feet high, and with correspondingly long ears, nearly ripe.

Besides the exuberant growth of most grains there is a remarkable vitality imparted to them in this region that astonishes a stranger. I am more and more convinced that it is not soil which is the cause of the astonishing crops produced in the west, but the peculiar climate. When digging up the prairie soil, even in the hardest clays, I could never go below the roots of the grass, and these were so numerous that they seemed to fill the soil. Owing to the severe winter's frost and the light rainfall in spring, the young roots are enabled to penetrate the soil to a depth wholly beyond the belief of an eastern farmer. They seem to follow the pores opened by the frost right into the subsoil and hence, instead of drawing their nourishment from four or five inches of soil they draw it from eighteen to twenty-four inches."

Mr. Macoun left Battleford, 31st July, for the Hand Hills, travelling south-westerly. Crossing the plain to the south of Battleford, at the seventh mile, began the ascent of the Eagle Hills and, after three miles more, camped outside of the line of woods which marks the crest of the hills.

"The following morning, for about five miles after starting, the soil was variable, with a large admixture of sand and some gravel, when it improved to first-class. The country was comparatively level for eight miles, until a deep coulée was reached, 90 feet deep and 500 yards in width, a chain of unconnected ponds lay in the centre of the depression and were, as usual, saline. Further to the south-east these became connected, and formed Tramping Lake, said to be 35 miles long. This coulée is the reported source of Eagle Creek. Two miles beyond the coulée was a salt lake about a mile in length. Three tests of the soil during the day produced similar results a rich black loam with a light colored clay loam subsoil. There are numerous small boulders on the knolls and in the coulée, but not sufficient to interfere with tillage. Water is good and abundant, but there are no creeks. The prevailing grass is Vilfa cuspidata, a species indicative of moist subsoil. Hedysarum boreale is here also, a prominent object peculiar to a moist climate.

A few miles further on crossed another coulée deeper and wider than the previous one, and the land for a short distance was not good, but it soon changed to the usual quality on the surface, but with a little more sand in the subsoil. Hills were sighted to the right which soon showed all along the western horizon. The prairie now took the form of great waves, nearly a mile apart, but rising towards the west. The last depression was a clay plain about three miles wide with a very rough surface, being much cracked and dry, although the grass was good. Thence, crossing a dry water course, the hills rise with a gradual slope and extend southward as a series of rolling hills. The plain just crossed extends for 40 miles to the north without a bush and is all fit for the plough. During the day only crossed one salt plain a quarter of a mile wide. Water has been abundant, but the indications are that a drier climate is being approached."

Mr. Macoun, on his return journey to Battleford, entered this section about lat. 52°, 50', travelling south-easterly.

"The country was almost a perfect level of good clay loam soil, and not a bush broke the monotony of the waving grass to the south. Bluffs of wood were seen about six miles to the north on the borders of Battle River, and at length blue hills rose in the distance. At about the 10th mile crossed the valley of Manito Creek, where water was obtained, but no wood except a few willow twigs. Thence, for some distance over the same kind of country, keeping along the heads of the coulées which ran towards the river, came upon ridges running north and south of light sandy loam, and struck the Sounding Lake trail in lat. 52°, 40', 54". For the last 20 miles, boulders have been common, and the approaches to all creeks and coulées stony, which indicates that the subsoil is drift, and that water will be abundant and sweet, although there is none on the surface at this season, 11th October. Thence, travelling along the trail easterly for an hour, reached the margin of the Eagle Hills, and wound for some miles through a broken country, at last reached Battleford."

Mr. Wilkins, P.L.S., Mr. Macoun's assistant, returningf rom the west towards Battleford, entered this section about lat. 52°, 18', journeying north-easterly. The country passed over to the Eagle Hills was a level or rolling prairie with no wood, grass and water abundant; passed a large boulder 12 feet high by 20 feet in length. For the first 25 miles the soil was a rich clay loam, and subsoil a lightish clay containing quantities of lime. Approaching the Eagle Hills, the soil changed to a sandy loam, the proportion of sand increasing as the hills were reached. He then descended into the plain, and crossing its belt of sand hills, arrived at Battleford 12th September, 1879.

Mr. Wilkins subsequently proceeded 60 miles south from Battleford, examined the country, and fixed the position of Tramping Lake. He found the soil to the south of the Eagle Hills an excellent clay loam.

*Surveyor-General of Dominion Lands Report*, 1880—*Geo. A. Simpson, D.L.S.*

"In the month of September I made a trip from Battleford up to the south side of Battle River, for the purpose of surveying a reserve for Chief Strike-him-on-the-back.

For about fifteen miles the soil is sandy loam, then come sand hills for ten miles, and west of this a fine prairie country with excellent soil. I believe there are about four hundred square miles here of good farming land, with a frontage on Battle River of from twenty to twenty-five miles."

See also *Appendix, Pac. Rr. Rep.*, 1879.

52/109 *Macoun Exploration*, 1879.

Mr. Macoun entered this section on latitude 52° 47′, travelling eastward.

"Crossing three successive ranges of hills through long grass and came upon a plateau, travelling over which reached the head of Manito Lake, and crossing at the west end of the lake a valley containing several ponds of alkaline water entered upon a rich level plain. Manito Lake lies in a great depression, about 300 feet below the prairie level, extending for many miles to the south-east and was extremely saline at the time (October). Heavy woods bounded it on all sides, except the north, where the banks are perpendicular and the country beyond all prairie and poplar copse. Travelling for seven miles eastward over the plain, it was found to be almost a dead level covered with long grass and clumps of poplar and willow. This was the first land seen that showed an excessive rain-fall during this expedition. Thence passed for 8 miles through a country too broken for agriculture, consisting of small rounded hills or narrow ridges, with all the hollows filled with water. Many green trees on the margins of the ponds stood in water, indicating that the rain-fall of this year was much heavier than usual. Thence for six miles over a rather broken country, when it became more level and drier. Near the 109th meridian crossed a large valley containing a lake, the slope of country here being to the south.

Mr. Wilkins entered this section about Latitude 52° 12′, journeying eastward.

Crossing a large stream 30 feet wide and nearly three feet deep, in a valley which was strongly alkaline, and on both sides of which were sand hills extending for two miles. The next 25 miles passed over a country of either rolling prairie or rolling hills. Soil, a strong black clay loam, with here and there boulders on the hills; no woods. Thence turning a little to the north-east left the hills and continued over rolling prairie, the soil was an excellent clay loam, with country well suited for farming. Abundance of wood was found in a valley towards east side of this section.

Mr. Macoun, on his journey from Battleford towards the Hand Hills, entered this section about latitude 52° 10′, travelling south-westerly, passed over an ascending rolling country for 10 miles without water, the soil being a strong clay considerably baked, and the herbage stunted.

"Absence of water was owing to the character of the soil, as experience has taught us that water could never be expected where clay land predominates." Thence leaving the clay entered upon a fine undulating country with a gradual ascent to the west, where was abundance of water, and luxuriant vegetation, with the exception of two narrow alkaline valleys.

See also *Appendix, Pac. Ry. Pep.*, 1879.

52

110 *Macoun Exploration*, 1879.

Mr. Macoun entered this section, latitude 52° 30′, travelling south-easterly to Sounding Lake near the Neutral Hills.

"For 12 miles the land was much broken, and contained a large percentage of sand; wood very small and scarce. Many salt marshes and lakes were passed, especially to the east of Nose Creek, which flows to the north through the centre of the poor stretch, and is about 12 feet wide and two feet deep. Proceeding on, met with occasional tracts of very good soil, and in about seven miles passed out of the woods, and entered on a wide prairie without a bush, which continued for ten miles, when the line of woods of the Neutral Hills was reached. On the latter portion the soil improved, but sand still predominated, yet much of it is fit for tillage. Mr. Macoun discovered that forest is no sign of good land in this region, the good land here being without wood, while the poor sand hills have abundance, the fire not being able to reach the latter owing to the absence of grass. The distance travelled since leaving Battle River was about 47 miles, 40 of which had been through a comparatively poor region, with wood on all the poorest sand hills, and the best tracts devoid of timber. From this point, about five miles north of Sounding Lake, Mr. Macoun travelled to the north-east to attain the latitude of Battleford. For the first 16 miles passed over true prairie, not a bush or tree being seen, but occasionally small patches of wood showed on the horizon on either side. Thence passing a creek supposed to be Ambush Creek, flowing into Manito Lake, came upon an alkaline flat, and shortly after entered among a few low sand hills where abundance of wood was obtained.

The elevation of the country became greater proceeding north, with abundance of wood and good water, when the ridges appeared with regularity, running east and west. The country improved, and the greater part of land passed over was of fair quality, with soil generally of sandy loam. Mr. Macoun ascended a high ridge in which were four coulées, which, united in about a mile to the west, seemed to form a creek flowing to the north-west, probably Eye-Brow Hill Creek of Palliser. Here, in a clump of poplars, a surveyor's line was struck, which proved to be the 110th meridian line run by Mr. Aldous during the past summer. The exact Latitude was found to be 52° 47′ 36″.

Mr. Wilkins entered this section south of the "Nose" in about 52° 9′, and proceeded eastward, found very fair soil. Passed within two miles of a lake which lay south of the Neutral Hills. Thence at about 18 miles east of the "Nose," ascended a series of hills running north and south, and entered a long valley which led to Sounding Lake.

Sounding Lake is a sheet of brackish water about seven miles long and four miles wide, surrounded on its north, east and south sides with wood, the poplar averaging about six inches in diameter. South of the lake, as far as could be seen, nothing met the eye but conical hills. Between Sounding Lake and the "Nose," the country is hilly, but contains good pasture, wood and water. The hills generally have a black loamy soil, while the valleys are principally clay or clay loam. Along the north shore of the lake the country is sandy, extending about six miles to the east, when heavy clay with dry grass is met with. The wood ceases as soon as the sand is left. South of this line of travel a series of hills were seen, which were doubtless a continuation of those crossed over before reaching Sounding Lake.

See also *Appendix, Pac. Ry. Rep.*, 1879.

52

**III** *Macoun Exploration*, 1879.

Mr. Macoun entered this section about latitude 52° 50′, proceeding in a south-easterly direction toward the Neutral Hills.

The soil is a black clay loam. A continuous poplar forest stretches along the northern horizon, but wood is scarce on the route travelled. Hitherto the dry beds of creeks seemed to indicate the flow of water to be to the south, but now the signs of the discharge of water to the north-east became apparent. At about the tenth mile after entering this section, a large lake was seen in the distance to the north. The land is of first-class quality, but owing to the level character of the country, water is scarce. Continuing on, crossed the Victoria trail, and then at about midway across the section, struck a small brook in a deep valley discharging its waters to the north. This was the first running water seen since leaving Hay Lakes, a distance of over 60 miles. The country continued the same until a high hill (Observation Hill of Palliser), Latitude 52° 36′ 20″, was reached. Hence to Battle River it is very much broken with hills, swamps and lakes, the latter being all fresh, except one close to the river. Several fine bluffs of wood were seen during the last few miles. Battle River, at the point crossed, flows through a valley about three miles wide and 300 feet deep, within which was quite a large lake, together with others of smaller size. The river meanders through a somewhat narrow sub-valley, between alluvial banks about ten feet high, and which are evidently overflowed in the spring. The river here is 40 yards wide and less than two feet deep, with a gentle current. There was some good timber still in the valley, principally balsam poplar. It may be stated generally that all the country seen between Hay Lakes and Battle River is fit for agriculture. Continuing the course, and ascending out of the valley, several fine bluffs of poplar were passed, and the land showed a decided tendency to become sandy, but fully one-half being, at present, covered with forest, it bears a rich growth of grass and herbaceous plants of various species. About four miles east of Battle River, and for a distance of three to four miles, the country became more picturesque, being studded with poplar copse wood, bare rounded hills, grassy slopes and small lakelets of pure water, in and around which sported numerous flocks of ducks and geese, giving animation to this beautiful panorama. This land, though light sandy loam, was fairly good. A valley of blown sand, with a skirting of poplar woods, was then entered, and the land became poor and sandy.

Mr. Wilkins entered this section about Latitude 52° 18′, travelling easterly towards the Neutral Hills. For about 15 miles strong clay, intermixed at times with considerable quantities of gravel, was the prevailing soil, grass and water abundant and good.

In coulées leading into Beaver Dam Creek a seam of coal nearly 4 feet thick was found, Latitude 52° 15′ 42″, resting on the usual sandstone, and overlaid with the drift, as Mr. Macoun found the coal south of Red Deer River. The valley of Beaver Dam Creek is about 600 feet broad and 125 feet deep, containing a large quantity of spruce and poplar.

To the east of this creek crossed a high ridge, running due north and south, presenting many outcrops of sandstone and lignite. Hence to the "Nose," a distance of about 24 miles, the country, which was very much cut up with coulées running north and south, was poor and gravelly, with alkaline swamps, inferior pasture, and no water. The "Nose" Hill, about meridian 111°, was found to be about 350 feet high, quite steep, and covered with abundance of poplar. From its top the Hand Hills were visible to the south-west. To the north and east the country was broken, but much of it was covered with wood. Excellent water was found in all the creeks. Latitude of the "Nose," 52° 09′ 52″.

See also *Appendix, Pac. Ry. Rep.*, 1879.

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112 *Macoun Exploration*, 1879.

Mr. Macoun, in his journey to Hay Lakes, visited Abraham [illegible]wyn, a former captain of Half-Breed hunters, who has settled on the [illegible] of Battle River, in the north-west corner of this section. Selwyn had [illegible] fields under cultivation on the prairie, 200 feet above the river. The whole country at the Crossing is well situated for settlement, being less encumbered with wood than a few miles back from the river.

Mr. Macoun entered this section proceeding in south-easterly direction to the Neutral Hills, and passed through the north-eastern corner. "During the greater part of the day we could see the wooded hills beyond Battle River, but they faded away towards evening. Water is very scarce now, but in the spring it is quite abundant, as there are a considerable number of hay marshes scattered over the country. Scarcely any growing wood passed to-day, all the clumps being killed by fire within a year or two; no sandy soil seen to day, and very few stones.

For eight miles after starting we travelled over a level plain having rich soil, but almost wholly without wood at present owing to constant fires.

We now passed to more elevated ground, and for five miles our course led over a lovely plain studded with popular copse and willow thicket; nearly all this wood was alive, though quite small. A descent of nearly 100 feet brought us into a valley where there was a large grove of balsam poplar. Beyond the valley the soil changed and became a light sandy loam, which very soon changed into the usual black clay loam. A continuous poplar forest keeps along our northern horizon, but wood is scarce where we are travelling."

Mr. Wilkins entered this section about its centre on his way from the Hand Hills to Tail Creek, proceeding north-westerly.

"The forest line was entered about Lat. 52°, and from thence up to Tail Creek, over one-third of the land was covered with wood. Numbers of the trees were over a foot in diameter, and everything indicated a fine country. The soil generally was a rich black loam with a clay or sandy subsoil, surface soil ranging from 15 to 24 inches in depth, and found everywhere around Tail Creek and Bull Lake. Birch, Elm, Maple (*Negundo aceroides*), Cottonwood (*Populus monilifera*), Balm of Gilead (*Populus balsamifera*) and spruce of a very large size and in considerable quantity were found in the valley of Red Deer River, which here ran in a valley 225 feet in depth and about half a mile wide. A number of seams of very fair lignite were seen and specimens procured.

Turning eastward at Tail Creek, Mr. Wilkins passed through the centre of the southern half of this section on his way to "The Nose."

Turning eastward he found the same black loam extending to the vicinity of Sullivan's Lake, a fine sheet of water about 20 miles long. East of this a strong clay was the prevailing soil, water and grass were abundant and good; intermixed with the clay there was at times considerable gravel, which made it more friable and easier worked.

See also *Appendix Pac. Ry. Rep.*, 1879.

52

113 *Macoun Exploration*, 1879.

Mr. Macoun entered this section at its south-west corner and travelled north-westerly to its north-east angle.

"The hills passed to-day were steeper than those seen yesterday, and contained more sand, but the land was generally suited for the plough. Passed the Antler Hills on our right, and shortly after sighted the Red Deer River on our left, keeping along it for six miles to the crossing. The soil was good, and the land fit for agriculture; the left bank of the river was clothed as far as we could see with poplar. From the river to Antler Hills was a level plain. This river at the crossing is nearly 200 yards wide and about two feet deep, with clear water over a pebbly bed. On the north side of the river, entered a thick forest of young poplars, which alternated with thickets of willow up to the Blindman's River. The soil was good, but became lighter and more sandy as we neared the latter stream in latitude 52° 22' 58".

Blindman's River is about 30 yards wide and 6 inches deep. After crossing the river the soil became more sandy and some gravel was seen, the first since leaving Deadman's River at Morleyville.

For nearly 5 miles the trail wound over hills and slopes of sandy loam, and then out upon a plain of great width, extending to hills bounding Red Deer River. The plain of Wolf Creek was covered with long rich grass and occasional clumps of tall willows. A few alkaline marshes and swamps were passed, but the greater part was suited for settlement.

As we approached Wolf Creek, the soil became drier and more sandy, and the country was covered with willow. Crossing this, passed a few swamps containing a sprinkling of spruce and tamarac, and then 5 miles over a fertile prairie to Battle River, which, at this crossing, is about as wide as Blindman's River, but contains more water. Its banks are only 10 feet high, and wooded to the water's edge. All herbaceous plants were wonderfully luxuriant, and all of forest species."

After passing Battle River the trail wound through low hills, sometimes forming ridges and enclosing numbers of small lakes of good water, and is described as "a rich farming country, none of it being unsuited for tillage except a little among the lakes, the soil being sandy loam." No hills of any size were seen except Bear's Hill, which is merely a low wooded eminence that breaks the monotony of the plain.

See also *Appendix, Pac. Ry. Rep.*, 1879.

$\frac{52}{114}$ See Appendix Pacific Railway Report, 1879.

$\frac{52}{115}$ See Appendix Pacific Railway Report, 1879.

$\frac{52}{116}$ See Appendix Pacific Railway Report, 1879.

$\frac{52}{117}$ See Appendix Pacific Railway Report, 1879.

$\frac{52}{118}$ See Appendix Pacific Railway Report, 1879.

## FROM THE 100TH TO THE 116TH MERIDIAN AND BETWEEN THE 51ST AND 52ND PARALLELS OF LATITUDE.

$\frac{51}{100}$ *Marcus Smith Exploration*, 1879.

Mr. Marcus Smith describes the south-west corner of this section :—

"The Duck and Riding Mountains are separated by a deep valley over a mile in width, with fine soil in the bottom. The slope of the latter is heavily wooded, but that of Duck Mountain is open pasture and more precipitous on the south-west side. On the north side there are belts of spruce and tamarac.

See also *Appendix, Pac. Ry. Rep.*, 1879.

$\frac{51}{101}$ *Dr. Smith Exploration*, 1879.

Dr. Smith travelled from Fort Pelly on a north line to Livingstone, and thence north-easterly through the north-westerly corner of this section :—

"In the immediate vicinity of the Fort the land is light, but good crops of roots and vegetables are raised in the garden. Timber is scarce in the immediate vicinity of the Fort, but very good timber for all purposes can be obtained in the Duck Mountain, eight miles off.

Between Pelly and Livingstone, a distance of 10 miles, the country is thickly strewn with boulders, chiefly granite and fine limestone. The Snake Creek, a stream 25 feet wide and two deep, runs parallel with the trail; its valley is very wide and deep. In this valley were many fine stacks of hay containing from five to six tons each.

Livingstone, or Swan River, barracks is situated on an elevated plateau, which is a vast accumulation of boulders in a sandy soil that cannot be used for tillage but is admirable pasture land. On both side of Swan River is land of very fair quality, though light, with gravelly subsoil. It is generally of the nature of prairie, though timber is by no means scarce, principally aspen poplar. Many swamps were passed, some deep and difficult to cross."

*Marcus Smith Exploration*, 1879.

Mr. Marcus Smith travelled through the greater part of this section on his way from Fort Pelly along the Assiniboine :—

"For 60 miles along the trail from Fort Pelly the soil is light, some portions of it swampy and dotted with ponds fringed with willows."

East of the Assiniboine, on his way from Fort Ellice :—

"North of Shell River, and extending from the Assiniboine to the base of Duck Mountain, is a beautiful inclined plain, partially wooded and the soil is very rich, especially near Big Boggy Creek, where we saw very heavy crops of grass, wild peas and vetches."

See also *Appendix, Pac. Ry. Rep.*, 1879.

$\frac{51}{102}$ *Marcus Smith Exploration*, 1879.

Mr. Marcus Smith crossed the southern part of this section on his way from Quill Lake.

"The valleys of the White Sand and Assiniboine Rivers merge into one and form an extensive low, level plain, on which there is an Indian Reserve. At the confluence of the two rivers the former is about 80 feet and the latter about 100 feet wide, and the banks about 20 feet high."

See also *Appendix, Pac. Ry. Rep.*, 1879.

$\frac{51}{103}$ *Marcus Smith Exploration*, 1879.

Mr. Marcus Smith, proceeding south-easterly, entered this section at its north-western corner on his way to Fort Pelly.

"There is a broad belt of fine country dotted with groves and clumps of poplar, giving the country a park-like appearance, stretching from the Qu'Appelle Lakes northward by the eastern slope of the Touchwood Hills and the Fishing Lake to the head waters of Red Deer River. The soil is generally a light loam."

See also *Appendix, Pac. Ry. Rep.*, 1879.

$\frac{51}{104}$ *Macoun Exploration*, 1879.

Entering this section near its south-east corner and passing to the north of Last Mountain, and in the direction of the north end of the Last Mountain Lake, Mr. Macoun thus describes the country:—

"We now began to feel that we were entering on the great treeless plain spoken of by Palliser. Numerous ridges containing gravel and white limestone boulders were passed, and in the hollows between numerous saline lakelets were seen. Beyond this the land descends gradually towards Long Lake. From our camp of 4th July. West of us Last Mountain reared itself up about 10 miles away. To the north-west no high land could be seen, but north-east the line of the Touchwood Hills was visible. Throughout the whole area passed over, the distribution of plants was very limited. One day one or two species will monopolize the whole soil, and the next day others and so on. Mushrooms are abundant and of enormous size."

"I had a pit dug in the very driest part of the hill, and found first-class soil, although the surface was largely covered with pebbles. After a few trials, I discovered that the pebbles were no proof of a gravelly soil, but were only a remnant of the prairie fires."

"All travellers throughout the north-west, having seen indications of gravel, have invariably noted the soil as being gravelly, where in reality hardly any could be found in the soil by digging."

"The top of Last Mountain was covered with wood, but its flanks were perfectly bare and naked. Flowers are a most conspicuous feature of these prairies, being in clumps or scattered, but always in the greatest profusion.

### GENERAL DESCRIPTION OF DISTRICT.

"Extending from the Qu'Appelle north-west by Pheasant, File and Touchwood Hills to Quill Lakes, and eastward to the vicinity of Livingstone, and southward a little east of the 102nd meridian, is a tract of country containing at least 7,000 square miles, or about 4½ million acres of excellent soil. It is true that its western side is almost devoid of wood, but to compensate for that, the hills extending all along this flank are covered with trees. Pheasant Plain, which extends from the crossing of the Pelly Road eastward for 25 miles, is altogether without wood, but the soil is exceedingly rich, and at no point is the wood to the south-west 10 miles distant. Proceeding northward of the travelled road the country becomes more broken, ponds and marshes are numerous, and wood increases both in size and quantity until it merges into continuous forest south of the location of the Canadian Pacific Railway. A rich black loam, about 15 inches in depth containing small grains, of quartz or other rock, is the prevailing surface soil, but this imperceptibly passes into lighter colored sandy loam, as the timber becomes more continuous and of a larger growth. The subsoil is generally a light colored, marly clay, but this again, in the ridges, passes into gravel, which is generally gneiss covered with a coating of carbonate of lime.

From a little west of the 102nd meridian boulders were numerous for about 20 miles, and occasionally afterwards, but no soil was seen too stony for successful cultivation.

At many points we dug into the subsoil and found it as above. Tested with acid it always gave indications of a very large percentage of carbonate of lime.

The timber on the tract passed over by me is of very little value, but good poplar for building purposes will be found in the hills. Other explorers who travelled the northern and eastern portion of this section, speak highly of its timber, and of its being in considerable quantity. Spruce is also found in the north-eastern corner of it, but much fine spruce is sure to be found on the head-waters of the Assiniboine, and can be floated down to any point.

Good water seems to prevail throughout the whole region, although there are few running streams, and those quite small. Leach Lake being fresh water, may contain fish. As there is abundance of timber in that section, and good water, a large settlement will spring up there in a year or two.

The grass marshes so frequently spoken of, are abundant in this section, and are from the size of a flower plot up to a number of acres."

See also *Appendix, Pac. Ry. Rep.*, 1879.

51
105 *Macoun Exploration*, 1879.

Passing around the north end of Last Mountain Lake and thence travelling south-westerly, through nearly the middle of the south half of this section, Mr. Macoun reports of it:—

"Last Mountain Lake lies in a depression that had a gentle descent from the east at least 10 miles; on the west side the land seemed to slope upwards to the west as gently as it did in the east. The plants about the lake are of a saline character, and the water slightly brackish."

"Remains of fish measuring 7¾ inches across the eyes and 9¼ inches from the intersection of the neck to the end of the jaw, were found at Last Mountain Lake and at the same place pelicans, geese, ducks, water-hens and numerous beautiful waders make their home. After a careful review of the location and condition of the Qu'Appelle Indians, I have come to the conclusion that there are more fish and fowl around or in this lake than would support them in comfort." "It is quite evident the Hudson's Bay Co.'s servants know little about it." Passing around the head of Long Lake from the east, Mr. Macoun writes: "Here we found a creek a few yards wide, with a sluggish current and very miry bottom. Scarcely a mile from the first creek we came to another of a totally different character. This creek had a gentle current of clear water, was nearly three feet in depth and about eighteen wide. A fish wier was seen a short distance above our crossing, showing that the fish ran up stream in the spring. In half a mile crossed another creek, but this contained much less water than the other."

"The middle creek, which is much the largest and which certainly contains fish in the spring, seems to be the stream which discharges Wolverine Creek. I believe the land on this stream will be found of unquestionable value, as the water in the creek was quite pure. It is quite possible that further exploration in this region will show that there are fine lakes here containing fish."

From the head of the lake to where he crossed the 106th meridian, Mr. Macoun describes the country as being rather rough, with good soil on the hills and the depressions more or less alkaline and marshy, with very long and thick grass as far west as Little Arm Creek.

*Marcus Smith Exploration*, 1879.

Mr. Marcus Smith, proceeding north-westerly from Qu'Appelle Lakes to the Moose Woods, travelled diagonally through this section.

"We crossed some tracts of good land, but generally the soil is not deep, resting on a stratum of gravel and sand, and it soon became difficult to find water for the horses and for culinary purposes.

About 40 miles from Fort Qu'Appelle we crossed a lumpy country, indented with numerous small ponds, around which are clumps of poplars; shortly afterwards we saw the Egg Hills, 10 to 12 miles to the south-west. The country became less broken but still rolling, and at 50 miles we entered on a bare prairie, not a bush to be seen as far as the eye could reach. We were nearly abreast of the west end of the Touchwood Hills, and entering on that dreary alkaline plain which is almost a desert, the soil only yielding a scant pasturage. This dreary plain extends from the Touchwood Hills westward nearly to the South Saskatchewan, southward to Long Lake and the range of hills which stretch from the head of it to the South Saskatchewan, northward beyond the telegraph line and beyond Quill Lakes."

See also *Appendix Pac. Ry. Rep.*, 1879.

51/106

*Marcus Smith Exploration*, 1879.

Mr. Marcus Smith, travelling north-westerly from Qu'Appelle Lakes to the Moose Woods, crossed the north-eastern corner of this section.

"The range of hills between the head of Long Lake and the Saskatchewan is broken up into detached groups, rising abruptly 200 to 500 feet above the level of the plains; they are entirely bare, the smallest bush not to be seen, but there are numerous ponds and lakelets, some of them containing good water, others are very salt and alkaline. Along the northern edge of this range there is a narrow strip of fine land, well watered, and we saw several herds of deer.

We struck the South Saskatchewan near the north end of the Moose Woods. We had been some days without wood for cooking and very short of water; that which we did obtain from marshy, dried up ponds and were forced to use, was abominable, and some of the party as well as the horses suffered from it. Even the Wolverine Creek, which rises away to the north of the telegraph line, where the water is sweet, becomes, before it reaches Long Lake, impregnated with alkali to some extent, though the water is still not bad and far better than that of the other creeks in the neighbourhood, some of which are unfit for use.

*Macoun Exploration*, 1879.

Mr. Macoun travelled through this section near the centre of the south half of it, crossing the Saskatchewan at "the Elbow," and bearing thence north-west to the 107th meridian, where it intersects Red Deer Lakes.

The country between the 106th meridian and the Elbow of the South Saskatchewan was found to have very little water and no wood except in the sand hills to the south-east of the Elbow, and the soil to be poor, gravelly, and very dry. Speaking of the valley of the Saskatchewan at the Elbow, Mr. Macoun says, "ash, elm, maple, poplar, choke-cherry, and white thorn are in thickets or single along the flats, but not a bush or tree is found on the prairie on either side of the river."

## RELATIVE LEVELS OF QU'APPELLE RIVER AND THE SOUTH SASKATCHEWAN AT THE ELBOW.

"It having been supposed, and even stated as a fact during my stay in Winnipeg, that the waters of the South Saskatchewan could be easily let into the Qu'Appelle River, I considered it of so much importance to ascertain the correctness of this, that my assistant, an engineer, levelled back 15 miles from the Elbow, and found that at that point the water surface of the Qu'Appelle was 73 feet higher than the Saskatchewan, on July 16th, 1879."

### SOUTH SASKATCHEWAN.

"We pitched our camp on the hill-top, about a mile and a half from the river, near a good spring in a coulée. Beneath us lay the mighty Saskatchewan, rolling its turbid flood between banks 250 feet high, seeming altogether out of place in this arid region. The river at our crossing was 770 yards wide, and the main channel over which our horses had to swim was not less than 500 yards. Shoals and sandbars were numerous, with occasional islands, but nothing to indicate that the river at this point was unsuited for navigation."

"Why the south branch should be thought unfit for navigation, I cannot understand. Mr. Hind, who passed down it in August, 1858, never speaks of its depth as being less than seven and a-half feet, and the current as never more than three miles an hour, except when close to the North Branch.

Palliser, who crossed the river about 20 miles above me, on 28th September, 1857, states that the water in the middle of the channel, where they lost their waggon, was 20 feet deep."

"While on the plains, I never heard of the river being fordable below the mouth of the Red Deer River. Palliser crossed it on a raft, 22nd July, 1859, about sixty miles above that point where the river was 250 yards wide, and from five to eight feet deep. When at the Blackfoot Crossing of the Bow River, a branch of the South Saskatchewan, 27th August, 1879, I found that it was with the utmost difficulty that horses could cross without swimming. No person ever mentions a rapid being anywhere in the river below this, so that I have come to the conclusion that there is nothing to prevent all the supplies wanted for the south-west being sent up the South Saskatchewan. Coal is abundant in the river banks at the Blackfoot Crossing, and farther eastward, so that there will be no difficulty as to fuel for steamers. Should an attempt be made to navigate the river, it will be found to have better water for a longer period of the year than the North Saskatchewan, as its head waters drain a greater extent of the mountains."

After crossing the Saskatchewan, Mr. Macoun writes: "We reached the prairie level, and kept on for eight miles through sand hills and poor soil until we were forced to stop by hills of blown sand right ahead of us. While the horses were feeding, I found a narrow valley between two high hills of pure sand, through which we were enabled to pass to the north-west of the hills. These sand hills extend all the way from Sand Hill Lake, on the Qu'Appelle, around the head of that valley, and thence across the Saskatchewan, above the Elbow, and down the west side for some distance from one to three miles from the river.

After we got through the hills, the country changed at once; the hollows produced long grass, and on the level prairie it was tall and green. Water was scarce, the country being too level to retain it. Not a tree or bush was to be seen in any direction.

During the forenoon (21st July), passed over a low range of hills or elevated ground, to Red Deer Lakes, which were covered with rich grass sufficiently long for good hay, and amply disproved the statement that this was a dry, arid country. The grass seen was not that of marshes, but good upland meadow grass, and it was particularly noted that the old grass had not been burned either during the last fall or spring, thus forming a mulch that retained all the moisture for this year's crop. These facts fully disprove the impression that this region is arid and unproductive.

See also *Appendix Pac. Ry. Rep.*, 1879.

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**Recent explorations indicate that the Elbow of the South Saskatchewan is further east, and the Hand Hills further west, than shewn on map accompanying Report of 1879.**

**Surveys are now in progress, which will determine with accuracy the longitude of important points in the North-West Territories.**

51
107 *Macoun Exploration*, 1879.

From the intersection of the 107th meridian with Red Deer Lakes travelling north-west to the centre of this section, Mr. Macoun thus reports:—

"Being determined to see if the lake had an outlet to the west, I walked along its margin while the train kept the plain so as to shun the coulées which were at least 150 feet deep at the lake. All the depressions on the plain contained good water, and the land was excellent."

"Observed a large creek flowing into the lake from the south." Speaking of the country north-west of, and adjoining Red Deer Lake, Mr. Macoun says: "Here we were in a region, where Palliser, 22 years before, found numerous species of large animals and the grass eaten so low that he could not get food for his horses, with the grass knee high, the wild animals all gone and the poor Indians perishing of famine."

A careful examination of Palliser's track shows that much of the country, thought by him to be arid, was made so by immense herds of buffalo that ate up every green thing. "The valley of Red Deer Lakes contains very little wood at present, and most of that is dry, but the remains of large trees were seen on both sides in the coulées, showing that continuous fires were surely doing their work."

"The range of hills, which seems to extend on both sides of the lakes is exceedingly rich and fertile, and the grass upon them is just as green as we could see it in May in Ontario. About three miles from where we took dinner we came on the western margin of them, and saw at our feet a wide plain stretching away unto the horizon, perfectly level, and seemingly without a bound in that direction. To the north-east we could see the Moose Woods. Right on top of the hill were the remains of a camp, and here both wheat and barley were growing luxuriantly. The soil on this plain is a strong clay covered with very rank green grass, which indicates a moist climate. We have now discovered that want of rain is not the cause of water being scarce, but the levelness of the prairie. Wherever the country is rolling there water is to be had in abundance. From the centre of the section, north to the 52nd parallel, the country is alternating prairie and rough hills with occasional sand dunes with climatic indications similar to those above described. Mr. Macoun's assistant, Mr. Wilkins, travelling from the centre of this section in a zig-zag course to near the south-west corner of it found the country as follows:—

"Up to the foot of the Third Prairie Steppe, which advances into nearly the centre of the south half of this section, receding towards the north-west and south-west, the country is generally a level plain, the soil a strong clay and very rough, being cracked up in many places, but the grass good everywhere." "Water is generally scarce, but a creek with very good water runs north-easterly from the south-west corner of the section, almost across it, occasionally widening out into quite large lakes. At the base of the steppe, the clay changed into a loamy soil, well suited for farming purposes; the grass being rank and good. In the south-west corner of the section was found a lake about two miles long and quite narrow."

See also *Appendix*, *Pac. Ry. Rep.*, 1879.

51
108 *Macoun Exploration*, 1879.

Mr. Macoun's assistant, Mr. Wilkins, travelling west across the centre of the south half of this section, says:—

"Entered rolling hills with numerous lakelets of fresh water. Travelled all day through the same description of country on a nearly due west course, and camped on the western side of the hills, all good pasture lands with excellent grass. Distance travelled, 19 miles. July 30th, travelled this forenoon over a very level plain with a stiff clay soil, but having excellent grass and numerous pools of good water. During this afternoon, country much the same. Camped on the edge of a large coulée, very difficult of access. Distance, 19½ miles.

This coulée, running nearly north and south, was found to be 250 feet deep and half a mile wide. Water flows through it in spring. Both water and soil were found to be strongly alkaline in the coulée. West of this coulée, to the 109th meridian, the country was the same as described above."

See also *Appendix, Pac. Ry. Rep.*, 1879.

51
109 *Macoun Exploration*, 1879.

Mr. Macoun's assistant, Mr. Wilkins, travelling west across the south half of this section, found the country as follows:—

Shortly after crossing the 109th meridan, in about Lat. 51° 25', a valley, 150 feet in depth and half a mile wide, was crossed. Soil, strong clay all day with plenty of good grass and water. From the coulée mentioned above, keeping nearly west, in less than an hour left the plain and entered on rolling hills and camped before crossing them. Soil on the hills, rich black loam with excellent pasture and good water. Distance travelled, 17 miles. Thence travelling due west, during the forenoon, the country changed from hilly to ridges, with gentle slopes of great length. The depressions had the usual clay soil and the slopes a clay loam. Good grass everywhere. Stopped for dinner at a range of small sand hills; Lat. of sand hills, 51° 17'. Entered the sand hills immediately after starting and saw some brushwood.

West of the sand hills, came on a saline valley, about the eighth of a mile wide, containing a chain of saline ponds, which were, doubtless, the head of a creek flowing into Red Deer River. This valley was about 200 feet below the level of the sand hills, these being themselves below the level of the plateau generally. The sand hills are about four miles wide, containing little grass but many pools of good water. After leaving the sand hills the land was of the same ridgy character that it was in the forenoon, and continued the same to the 110th meridian, which Mr. Wilkins crossed at about Lat. 51° 18'."

*Surveyor-General of Dominion Lands' Report*, 1880—*A. P. Patrick, D.T.S.*

Mr. Patrick travelled south-westerly from Battleford to Forks of Red Deer and South Saskatchewan Rivers.

"I left Battleford for the Forks of the Red Deer and South Saskatchewan Rivers, on the 6th August, 1878. The country passed over for the first 30 miles may be said to be fit for settlement, though the soil is light and wood is scarce. From this point to the Forks the soil is fair, but dry, and, in my opinion, unfit for farming; no wood, and water is only to be found at great distances. The Forks of the Red Deer River I reached on the 15th August, the distance from Battleford being 168 miles. I was fortunate enough to procure an excellent Half-breed guide at Battleford; his services proved indispensable, as water was to be found only in places known to Half-breeds and Indians. My horses, notwithstanding the distance travelled, were in good condition. A small birch bark canoe, which I had brought with me from Battleford, was of the utmost service crossing the Red Deer River; it not only enabled the provisions to be kept perfectly dry, but was also the means of saving time, as otherwise I should have been compelled to go several miles up the river before reaching some fordable point."

See also *Appendix, Pac. Ry. Rep.*, 1879.

### 51/110 *Macoun Exploration*, 1879.

Mr. Macoun's assistant, Mr. Wilkins, who crossed this section about the middle of its south half from east to west, describes the country as follows :—"August 4th. Started on a due west course passing rolling hills until 11 a.m., when we took dinner at the edge of the hills. Soil on the hills is excellent clay loam." "Now enter on an alkaline plain and for the afternoon were passing through a broken country with numerous saline lakelets and sweet water ponds. Soil very indifferent in quality. Distance travelled 24 miles.

"To the 111th meridian the characteristics of the country are similar to those above. No wood was seen."

Mr. Macoun says: "From Mr. Wilkins' description of the country, it is quite evident that the soil is not too dry to produce good grain."

Crossing the 110th meridian in about Lat. 51° 50' and travelling south-west, Mr. Macoun thus describes the country. "Starting from about the meridian August 6th, an hour after starting attained the top of the range of hills and saw another ahead. To the west of us was a higher range with an abrupt escarpment on its eastern face. These ranges were both sandy and contained a little brushwood. When we reached the top of the next range we found many steep coulées branching off in various directions. Availing ourselves of these, we extricated ourselves from the hills with much difficulty and crossed to their western side, where we found a valley of great breadth extending south-east and north-west; a creek seemed to flow along its western side, as "cut banks" were seen in that direction."

"After dinner we kept up the valley, and passed over a spur of the hills on the left, and then descended into the valley again, close to the creek. Where we crossed, it was seven feet wide with six inches of flowing water. The valley was very dry on the north side and numerous small cactus grew in it. Two miles beyond the creek we camped, but were chagrined to find that within two miles of us to the west we would have to cross again."

"August 7th. Crossed the creek this morning with little difficulty. All the morning we were going up ridge over ridge under an intensely hot sun surrounded by thousands of 'bulldogs.' Flies so bad at noon that the horses could not eat. "During the afternoon we crossed a rolling country where there were numbers of salt lakes in the hollows, with excellent water in the more elevated ones. Land to-day passed over good for little except pasture."

This brought Mr. Macoun to the 111th meridian.

See also *Appendix, Pac. Ry. Rep.*, 1879.

### 51/111 *Macoun Exploration*, 1879.

Entering this section at about Latitude 51° 30', and travelling south-west to about the centre of the south half of it, Mr. Macoun thus describes it:

"For a mile or two after starting the country improved, but soon it became dry and stony, with great numbers of boulders on all the little hills." Near the centre of the south half of this section, having come on Mr. Wilkin's trail, which crossed it from east to west, Mr. Macoun says: "Turning west we passed for an hour over alkaline flats, covered with Artemisia cana, which may be said to be the "sage brush" of our plains, then rolling hills of the same character, but passing at last into richer soil and better grass, with a fine level country. We now began to ascend gently over a fine prairie, and camped at its highest point. This is the finest country I have seen for a week and well suited for the plough. Soil a rich black clay loam with long grass that indicated moisture beneath; nearly north of us is a chain of small lakes which are brackish."

Passing north-westerly from this point, Mr. Macoun thus describes the country: "During the afternoon the country was nearly level, except that it rose gently to the west, with occasional depressions of little depth. This is the driest region we have yet seen, as abundance of small cacti are growing on the plain between the creeks. After we passed the third creek the land became more elevated, and at our camp the grass was good with abundance of water. About 5 miles from camp crossed a large creek with flowing water about 7 feet in width and 6 inches in depth, and in half an hour another one. Between the two creeks the ground is very rocky, boulders being thickly strewed over the surface. Late in the evening reached Blood Indian Creek, with banks 150 feet high."

The lines explored by Mr. Wilkins, both north and south of Mr. Macoun's line, were of the same character as that described above. Mr. Macoun in his general report of this section, says: "The dry arid tract now under consideration has more creeks with flowing water in them than are to be found in all the rest of the plain. Here flowing water and cactus with dried up grass and poor soil gave another proof that the Cretaceous clay was a factor in more problems than one. In no section of the country did we ever find the water running in streams on the surface after a storm except here, where it was so dry."

### GENERAL REMARKS ON THE GREAT PLAIN.

"After seeing the 'Great Plain,' I can state distinctly that the rainfall throughout the whole region is sufficient for the growth of cereals. Coming, as it does, in June and July, when the crops actually need it, and ceasing when ripening commences. Wherever the soil was suitable for the growth of grasses, there they were. Sand (except moving sand) or gravel was no exception. But wherever the "banded clays," spoken of by Hector, in Palliser's Report, page 229, came to the surface, there was cactus and artemisia, with a saline soil and an appearance of aridity not warranted by the climate. A more minute examination of the country will locate these apparently unproductive soils, and show that they are a very small percentage of the whole. After seeing the country at its worst, when it was suffering from intense heat and dry winds, I wrote: 'Wherever there was drift without these clays there was good grass, but wherever this soil prevailed, aridity showed itself at once.' Many of the hill-tops were dry and burnt up, but, had they been ploughed in the spring, would have yielded a good crop, as the summer rains, which undoubtedly fall over the whole country, would have passed into the soil, instead of running off or passing in a few hours into the air, as they do under the present condition of things."

See also *Appendix Pac. Rep.*, 1879.

**51**
**112** *Macoun Exploration*, 1879.

Crossing the 112th meridian at about Latitude 51° 26', and going west to the discharge of Little Fish Lake, Mr. Macoun says:—

"Country quite dry until we came within three miles of the lake, when it became more broken and changed into a series of rolling hills with excellent water in the hollows and very fine grass in the numerous little valleys. On the level plain cactus was abundant and the grass was burnt up; in the hills no cactus and good grass. A chain of rolling hills extends from north to south-east of the head of the lake, and ends abruptly near Red Deer River."

"The lake is over three miles in length by one in breadth, and contains fresh water, but is so filled with a green confervoid growth that it is unfit for use except in extreme cases. Numerous fish are caught at the discharge of the lake in spring. About its centre, on the north side, a small creek enters which discharges a larger lake lying east of the Hand Hills. The horses found good pasture on the shores of the lake." Speaking of the country between Little Fish Lake and the Red Deer River, Mr. Macoun says: "The whole plain between this and the river was hard baked clay and very much cracked The valleys are profound, but as the eye ranges over the level plain, no break can be detected."

Travelling south from Little Fish Lake to where the 112th meridian intersects the Red Deer River, Mr. Macoun says:—

"I started for Red Deer River, distant about seven miles, to the south. Experienced much difficulty in reaching the river owing to the coulées which ramify in all directions from it; these being from 250 to 300 feet deep, and their margins like cut banks. These coulees contain more or less brushwood and a few trees, but were generally narrow until we approached the river; then they widened out. Very little wood grows along the river and that close to it. Scarcely any vegetation was found in the valley except cactus and artemisia, which occupied the greater part of the surface. It was the hard baked clay that hindered all other vegetable growth, and not the dry climate." "The valley was about 1,000 yards wide, the river itself about 140, and the height of the banks nearly 300 feet on the east side, but fully 200 higher on the west. The river valley as usual was very dry. Its right bank looked from the camp like the broken face of a very rugged mountain, rising in bare rounded knolls one over the other fully 500 feet. A few very large trees were in the valley where we crossed; one poplar was 13 feet in circumference, and others nearly as large."

Travelling from about the intersection of the Red Deer River with the 112th meridian southwest to the 51st parallel, Mr. Macoun reports:—

"I had carefully examined all the slides from the valley, as we went up the hill, and observed that this bank was the same as the other up to the limestone exposure. Seeing a bold escarpment topping the bank at a particular point, I went there and discovered a fine exposure of sandstone. The beds got harder as I approached the top, and for a few yards the rock on its upper surface was laid bare by the washing away of a seam of soft shaly lignite which lay immediately above it. The seam was about four feet in depth, and above it was a layer of quartzite gravel followed by the usual prairie drift. I discovered a very fine out-crop of a first-class lignite, at least five feet thick, in a small coulée opening into the 'Crawling Valley.' The beds seen at this point agree in no particular with those seen by Dr. Hector further up the river. He states that the lignite seen by him was nearly on a level with the water, whereas this is on the surface. I believe these strata are referable to the same beds as those occuring at Porcupine Creek on the Boundary." See Dr. Dawson's Report, page 98.

"Crawling Valley extends from Red Deer River to Bow River at the Elbow." "As far as seen, numerous springs of fine water issued from its sides."

From Red Deer River, Mr. Macoun proceeded south-westerly in the direction of Blackfoot Crossing, and thus speaks of the country:—"For two miles after starting the country was level, but after that it became rolling, and increased until we stopped for dinner. After dinner, the depressions between the hills were all clay, and, as usual, much cracked. The hills were rather higher, and the valleys longer and wider, and fresh water scarcer, than in the forenoon. The soil on this side is much better than beyond the river, and, as a consequence, the grass is longer. There is abundance of fresh water in the ponds and marshes, and no sign of salt lakes. This country extends ten miles to the south-east, and after that it becomes more sandy, passing eventually into sand hills."

Mr. Wilkins passed north-westerly through the northern half of this section, and reports:—"On the Hand Hills the land was found of fair quality, but the pasture dry and much parched. The northern face contained some poplar of a fair size. Between the Hand Hills and the Squirrel's Head the land was generally a hard-baked clay, intersected by coulées, or a plain covered with poor grass and a gravelly soil. After entering the rolling hills, at the Squirrel's Head, the soil improved, and the valleys were filled with good grass. The clay, instead of being baked, became friable and better suited for farming purposes."

See also *Appendix, Pac. Ry. Rep.*, 1879.

51/113 *Macoun Exploration*, 1879.

Mr. Macoun passed westerly through the south-western corner of this section on his way to Calgarry.

While crossing through this section, Mr. Macoun passed over long slopes extending eastward, with very little dip to the west. All the land seen was sandy loam, and all fit for the plough. Occasional patches of boulders were seen, but they were not too abundant.

See also *Appendix, Pac. Ry. Rep.*, 1879.

51/114 *Macoun Exploration*, 1879.

Entering this section at the south-east corner, and keeping north of Bow River, travelled westerly, towards old Bow Fort.

"Passed over long slopes extending eastwards, with very little dip to the west. All the land seen was sandy loam, and all fit for the plough.

Two miles before we reached the Fort (Calgarry,) we stopped on the top of the last slope and looked over a scene long to be remembered. At our feet lay Bow River and its beautiful valley. As the river wound from side to side it left wooded points on the outer margin of all bends, and from our altitude, water, wood and meadow seemed so beautifully intermixed that the landscape was more like an artist's ideal than a natural picture. Standing by the river's margin, or feeding on the green meadows, were hundreds of cattle and horses; these added to the natural features and gave a pastoral character to the scene. Only three short years ago this same valley was filled with countless herds of buffalo, and the Blackfeet and Surcees were in the midst of affluence. To-day, the buffalo are dead or gone, and the Indian, broken in spirit, either dies with the stoicism of his race or partakes of the white man's bounty. Calgarry itself lay hidden among the distant trees, quietly nestling under a bluff of light colored sandstone, while about a mile beyond, in a little grove, could be seen the Catholic Mission, presided over by Father Scollon. Outside the river valley, the prairie extended roll over roll into the horizon, dotted here and there with clumps of bushes, but altogether without trees, except in the valleys of the small streams. Behind rose the Rocky Mountains like a wall, bounding the horizon to the west, and giving a vastness to the picture which the beholder could feel but not describe."

"Calgarry is situated on the right bank of Bow River, in the angle formed by Elbow or Swift River, where it joins the former. It is merely a stockade, about ten feet high, enclosing a few huts, but would be very little protection if the Indians were troublesome."

Bow River, at the crossing, is a fine stream, 100 yards wide, of clear, cold water, running with a strong current over a pebbly bed, and contains an abundance of fish,—trout and pike.

Elbow River is a fine mountain stream, about 40 yards wide. All the streams discharging into Bow River are full of fish, principally of three varieties of trout. "The whole country from the Blackfeet Crossing to Fort Calgarry, except the sand hills in the Blackfeet Reserve, is first-class as regards soil."

1st September, John Glen's farm on Fish Creek, about six miles south of the fort. "Here Glen had 5,000 cabbages all commencing to head, and without doubt the finest lot I had ever seen. Barley and oats in the same field were excellent, and potatoes very fine. Mr. Livingstone, another farmer living a few miles off had also excellent crops, and all united in saying that the climate was moist enough to grow anything." Glen's grain was scarcely fit to cut, and I suspect that proximity to the Mountains has a tendency to cool the nights, and hence slower growth than farther east. All the land seemed to be either a sandy or clay loam, and very fertile. At the Roman Catholic Mission all kinds of grain and vegetables had been raised, and although most of the ground had been broken up this spring, the crops were generally good. The Father and his brother had done all the work themselves, and done it well.

2nd September. This was the first time the mercury reached the freezing-point since we started. Potatoes and beans slightly touched. Started to-day for Morleyville, and camped about eight miles out. The country passed over was generally very good, but the hills increased so much in altitude that one was almost tempted to call them the Foothills of the Rocky Mountains. Willow bushes now became a marked feature in the country, and indicates an abundant rain fall as well as a cooler climate. From our camp, the high land, which forms the Foothills on the south side of the river, was plainly visible, rising to the west in successive ridges, and finally melting into the blue haze which hung around the base of the mountains. Water abundant and good.

3rd September. For two hours after starting, our course was over fine prairie covered at times with willow brush, and then descended into the valley of Bow River, and passed the remains of an old poplar forest, the balsam being quite large. After reaching the river valley we crossed Pine and two other creeks.

The country now began to assume a mountainous character, the hills rising nearly 600 feet above the river with correspondingly deep valleys. Still approaching nearer to the mountains, passed over much good soil covered with willows, as well as other land of very inferior quality. The land now became terraced along the river, and was generally up to old Bow Fort, and beyond nothing but masses of shingle and quartzite gravel, with a thin coating of earth, or none at all.

The approach to Deadman's River, a mountain stream about 30 yards wide, and two feet deep at present, is steep and dangerous. Crossing this stream at its confluence with Bow River, we ascended the two terraces again, and drove five miles to Morleyville over a very good road, but land wholly unsuited for agriculture. The road was on one of the river terraces, but to the right the ground rose in grassy slopes over 200 feet, and in this upper tract were situated the lands suited for agriculture. Beyond the river the land seemed to be much better, the hills were lower and farther off, and wood was in considerable quantities. Observed patches of spruce on the higher and more exposed hill tops, and occasional pines clinging to the rocky cliffs of Bow River.

Morleyville is situated in a most admirable locality and the scenery is unsurpassed in the North-West. The hills and valleys are covered with nutritious grass, which is as available in winter as in summer owing to the "Chinook" winds, which frequently blow at that season, evaporating the snow and leaving the grass as good as it was in August. During the warm, dry weather of August, the grass of the whole plains becomes dry except a small portion in the centre of each little tuft, and, as there is scarcely any rain either in September or October, when the snow falls towards the end of the latter month it sifts down among the dried grass, not moistening it in the least; here the snow lies until the "Chinook," a warm, dry wind sweeping along the base of the Rocky Mountains, takes it away. Morleyville is justly celebrated for its excellent cattle runs, but the advantages it has over the Great Plains consist in its brooks and numerous springs, and the many sheltered valleys leading up from Bow River. There is not the slightest difference between the pasture grasses of Morleyville and those of Fort Ellice, 600 miles to the east.

How far the effects of the "Chinook" winds extend eastward is unknown, but the fact of the Great Plains, around the Hand Hills, being the wintering place of the buffalo for untold ages, leaves no doubt that the snow-fall is either very light or quickly melted. It must not be forgotton, in discussing the question of wintering stock on the plains, that no water is needed, the snow eaten with the grass being sufficient.

The Mission is very well constructed and everything around betokens care and industry. Mr. Seibold, the teacher, and Mr. Robinson, the gentleman in charge of the Mission, in Mr. John McDougall's absence, are both fine m
Crops here are late but good, and all kinds of vegetables are excellent. A
are now at an elevation of nearly 4,000 feet and close under the mountain
ought to be at the limit of farming for profit, but those who have been here
years deny it. They state that this has been a late season and crops are not as far advanced as usual. Taking their statements as true, and I do not doubt them, all kinds of grain can be raised here as well as any where else, but, owing to the altitude, they will not ripen early.

The Stony Indians are now becoming farmers, having had 40 acres on their reservations put in crop this season. Each of the four chiefs has ten acres under cultivation."

### MORLEYVILLE TOWARDS HAY LAKES.

On his return journey Mr. Macoun left Morleyville on the 15th September, travelling north-westerly towards the Hay Lakes. "A few miles after starting, passed a fine creek running through a valley three miles in width, on the west side of which were a number of poplar groves, which looked like the remains of a former poplar forest. Thence over a high rolling prairie having an excellent soil of black clay loam, sometimes mixed with slaty gravel, like that seen at Morleyville. Climate cool and moist, and the plants indicating considerable altitude. Willow brush covered nearly the whole country, and occasional clumps of balsam poplar showed in the boggy spots, being saved from death by their proximity to water."

In the distance we could see bluffs of spruce crowning the hills to the west, while Edge Creek seemed to flow parallel with our course, which was generally northerly over a fine rolling country, the land continuing of excellent quality and well suited for the plough, passing several fine streams and occasional lakes. The drainage is perfect, all the slopes being gradual, and the water scarce. Far as the eye could reach to the north-west the land seemed of first-class quality, but with very little wood. Before reaching the Calgarry road we passed the old forest line; it is now marked by large willows and a few clumps of poplars. In some places a scarcity of water was experienced, owing to the level country and good soil preventing water standing on the surface. On nearing the north-east angle of this section, entered a range of low wooded hills where wood and water were plentiful. These are called the "Hunting Hills." The "Antler Hills" being to the right.

*Surveyor-General of Dominion Lands Report*, 1880.—*A. P. Patrick, D.L.S.*

Mr. Patrick passed along the south side of the Bow River on his way westward from Fort Calgarry to Morleyville.

"From Fort Calgarry I proceeded to Morleyville by the Elbow River to lay out the Stony Reserve. The country from Calgarry to "Jumping Pound" Creek, a distance of about twenty-four miles, is similar to that described at High River. About six miles from Calgarry, on the Elbow River, is a settler named Samuel Livingstone. This man has a fine improved farm, and the crops raised have been something wonderful. I am informed that his oats averaged something like fifty bushels to the acre. The land from Jumping Pound to Morleyville is good, but the country is very hilly; the feed is excellent, and the whole section is particularly well adapted for a cattle ranche. While at Morleyville, I laid out the Stony Reserve, as shown on the sketch I have already forwarded. The land on the reserve is suitable for cattle raising; there is also a quantity of good farming land sufficient for the wants of the tribe. While writing of the Stony Indians, I consider it worth noting that they have already acquired considerable knowledge of farming; they, this year, succeeded in raising a tolerably large crop of barley and turnips. The settlement at Morleyville contains a Church, which reflects great credit on the energy of the Rev. John McDougal, Methodist Missionary. There is also a school house of ample dimensions, the clergyman's residence, and another building occupied by the Indian schoolmaster. At various points, embracing in all about eight miles, along the Bow River, towards Calgarry, are about ten settlers, whose farms have been more or less improved; all are in possession of more or less cattle. These men contemplate going principally into cattle raising. They wish to obtain from their farms little more than sufficient for their own consumption."

See also *Appendix, Pac. Ry. Rep.*, 1879.

51/115 *Macoun Exploration*, 1879.

Mr. Macoun entered the southern portion of this section, travelling westward to Grotto Mountain. "After leaving the Mission (Morleyville) the country became rough, and slaty sandstones came out in ledges" "Observed a number of pines of a species unknown to me; and a few small groves of Douglas pine. I found afterwards that this species covered more or less all the Foothills, and extended up the river valley into the mountains. All the ravines were lined with spruce, which never grew to a large size. Proceeding up the valley, camped on the site of Old Bow Fort."

"Bow River, above the Mission, becomes more rapid and partakes of the nature of a mountain stream, its banks, at times, are sandstone cliffs; and when this rock crosses the stream short rapids are formed. From below Deadman's River, terraces without any regularity are common. At Old Bow Fort, the river is 600 feet below the general level, and flows in a narrow valley. The sides of a gorge near the camp, 100 feet deep, through which flows a mountain brook, show the usual purple shales, containing more or less impure iron ore. Further up these shales form cliffs, 500 feet high, abutting on the river, around which it leaps and foams with great force. Here it had forced its last barrier before leaving the mountains; and for 20 miles higher up there was little current. Moved camp 7 miles, and found ourselves at the entrance to the pass. The mountains rise on either hand; those to the south being covered with wood, while those on the north are bare and very precipitous. My examination of the rocks along Bow River led me to think that they bore a great resemblance to rocks I had seen on Thunder Bay, belonging to the Huronian series. A few fossils were obtained, which were unmistakeably Lower Silurian or Devonian types. Found the mountain (near camp) to be a heavy-bedded blue limestone, weathering white, containing few fossils except crinoid stems.

Sept. 8.—Moved camp up to Grotto Mountain; found abundance of fine trout in the river, of three species; the smallest being about a foot long, and in appearance, like our eastern brook trout; another, rather larger, but with soft white flesh, and the third which often attains a weight of 30 pounds, in the lake and deep pools bordering on the river channel. Mountain goats and sheep were frequently seen; so that with these and the fish there is no danger of the Stony Indians starving, if they do not become too lazy to work. The valleys were filled with shingle carried down from the mountains, which were rotting away. All the plants observed were strictly Alpine. Several fossils were obtained, evidently Devonian. Snow showers were frequent.

A careful examination of the timber in the valley as far as time would allow, was made. The principal species were Douglas pine, and beautiful spruce, the latter growing tall and straight and forming groves on the flats. The other species preferred the rocky slopes, and were often of a large size; numbers being seen three feet in diameter. Fine groves of timber were observed on the south side of the river, from the mouth of the Kannanaskis up its pass and over the mountains between the two rivers. From the situation of the timber, I believe it to be principally Douglas pine. I was informed that much finer timber could be seen higher up the river. By being carefully husbanded, there is a enough timber on this river and its tributaries to supply all the prairie country as far as the Elbow of the South Saskatchewan. All the water-power necessary to convert it into lumber exists close to Morleyville, and the river is so placid that it could be rafted to any point without loss.

See also *Appendix, Pacific Railway Report*, 1879.

## FROM THE 100TH TO THE 115TH MERIDIAN, AND BETWEEN THE 50TH AND 51ST PARALLELS OF LATITUDE.

$\frac{50}{100}$ *Marcus Smith Exploration*, 1879.

Mr. Marcus Smith entered this section on his way from Shell River to Bird-tail Creek.

"North of the Assiniboine the country rises gradually and imperceptibly to the eye up to the crown of the Riding Mountain, 2,000 feet above the level of the sea. The southern portion of this district is chiefly prairie; the soil good, but light in some places, and in others largely mixed with boulders. The depth of the soil increases northward and its quality changes to a heavy loam, well suited for permanent wheat-growing; groves and belts of poplar become frequent and ultimately merge into a solid forest, in which there are good spruce and tamarac.

The north-eastern slopes of Riding and Duck Mountains are precipitous, and the flat between them and Lakes Manitoba and Winnipegosis is generally marshy, intersected with sand and gravel ridges covered with spruce, tamarac and some maple, and some strips of good land interspersed."

See also *Appendix, Pac. Ry. Rep.*, 1879.

$\frac{50}{101}$ *Macoun Exploration*, 1879.

"Between Fort Ellice and the river (Qu'Appelle) the road passes mostly through copsewood, with occasional ponds and marshy spots for over a mile, and then descends a long wooded slope until the level of the river is reached."

"The vegetation in the river valley (Qu'Appelle) is of the most luxuriant description; peas, vetches, and wild hops vied with other in luxuriance and climbed over bushes and logs to the almost extinction of other plants."

"As soon as we crossed the river (half a mile from its mouth) we entered almost at once into a series of abrupt sand hills which seemed to fill the valley at its lower end." "None of the Qu'Appelle Valley, as far as seen, was fit for agriculture."

Westerly from the mouth of the Q'Appelle River above the valley, and adjacent to it to the north, "the soil is rather poor, but there is nothing to prevent settlement, as sufficient good land will be found on each section to warrant its location, and the vicinity of the rivers with their wooded valleys will possibly make it a favorite residence for many."

Westerly from Big Spring "the country improves, and for a number of miles a beautiful sandy prairie with little wood stretches out to the horizon, bounded to the west by a low range of wooded sand hills. Beyond these to Antelope Creek the country, though sandy, is rich and beautiful, containing many bluffs of very good poplar." Around Spy Hill the land is much broken, and there are numerous marshy ponds in the depressions, with corresponding ridges of sand or gravel." "Cut Arm Creek flows in a valley of considerable depth." The land is good but very wet.

Generally between Cut Arm Creek and the 102nd meridian the soil is a rich black loam with a light-colored marly clay for a subsoil. "The various herbaceous plants are wonderfully luxuriant." See general description by Macoun in $\frac{51}{104}$.

*Marcus Smith Exploration*, 1879.

Mr. Marcus Smith traversed this section in various directions.

"The soil east of the Assiniboine, on the main trail from Bird Tail Creek to Fort Ellice (a distance of 12 miles), and extending southward to the Assiniboine, is good, but largely mixed with drift boulders, which will cause a great deal of labor and some years to remove for their sufficiently to allow the land to be worked freely.

The valley of the Qu'Appelle, at the lower end, is sandy, but before reaching the Big Cut Arm the soil improves, and we find crops of grass which would make good hay. The valley is a mile to a mile and a half wide, and the river about 80 feet.

Proceeding down the Assiniboine from Fort Pelly.

On the last 50 miles to Fort Ellice the soil is fine gravel covered with a thin sod, making excellent roads, but very poor pasture.

From Fort Ellice, up the east side of the Assiniboine, to Shell River, is a belt of gravel ridges, evidently a former beach, or river bed, some ten miles wide, covered with a thin sod."

See also *Appendix, Pac. Ry. Rep.*, 1879.

**$\frac{50}{102}$** *Macoun Exploration*, 1879.

Midway between the Qu'Appelle River and the 51st parallel of Latitude, and from the 102nd meridian westward, Mr. Macoun says: "During the afternoon we travelled principally through prairie, with a gradual upward slope and better drainage, the whole country being well suited for farming purposes;" and during the next day, 27th June: "The country passed through to-day was very lovely, but wood was scarce, in fact less than one per cent." "The tract passed over to-day is much better drained than that seen since leaving Fort Ellice. The creeks are more defined, and the country rises in easy undulations to the south." "Shortly after crossing it (Primrose Creek), we entered on the north-eastern bluffs of Pheasant Mountain, which is merely a slight elevation above the usual prairie level. After passing through lovely copsewood for over an hour, we stopped for dinnner at a pool of good water."

See $\frac{51}{104}$ for general description, by Mr. Macoun.

*Marcus Smith Exploration*, 1879.

Mr. Marcus Smith, travelling from Fort Ellice on the main cart trail, entered this section west of Cut Arm Creek.

"West of the Big Cut Arm Creek the land improves a little, but is still light, and the ground is indented with numerous small ponds. This is the general character of the country between the Qu'Appelle and the main cart trail to Carlton, until reaching the Pheasant and File Hills, the rise of which is scarcely perceptible to the eye, but they are partly covered with groves of aspen, and the soil is deeper than on the open prairie."

See also *Appendix, Pac. Ry. Rep.*, 1879.

$\frac{50}{103}$ *Macoun Exploration*, 1879.

Travelling west from the northern limit of the Pheasant Hills and passing south of File Hills to the 104th meridian, about half way between Fishing Lake and the 51st parallel of Lat., Mr. Macoun thus describes the country: "Shortly after leaving camp crossed the creek (Primrose) for the third time, and then entered on the plain which lay spread out before us with the Pheasant Hills stretching away to the south, while File Hills could be dimly seen in the north. Very few water pools were seen and no marsh (from Pheasant to File Hills.) The whole plain lying between the two ranges is dry and level, with a gentle inclination to the south, and having a fertile soil without stones. Abundance of wood can be obtained for all purposes on the File Hills. We now touched the south-east corner of the File Hills, and passed for six miles through a park-like country with clumps of wood and occasional water pools. For the distance the land could not be better. Between Pelly and Touchwood Roads is the best tract of land we have yet seen. The whole region is wooded and slopes gently towards Qu'Appelle."

See sec. $\frac{51}{104}$ for general description by Mr. Macoun; also sec. $\frac{50}{103}$ for Mr. Marcus Smith's description.

See also *Appendix, Pac. Ry. Rep.*, 1879.

$\frac{50}{104}$ *Macoun Exploration*, 1879.

Passing through the north-east corner of this section, Mr. Macoun says of it:

"A boundless grassy plain stretched away to the horizon on every side, rising in easy undulations to the north, but falling with the same easy slopes to the south. No sign of bad land. This country would be all forest were it not for the fires."

*Marcus Smith Exploration*, 1879.

Mr. Marcus Smith crossed the northern part of this section on his way from Fort Ellice.

"The French Missionaries, Half-breeds and Indians cultivate less or more land in the vicinity of Qu'Appelle lakes, and raise all kinds of vegetables, barley and Indian corn and some fruit, as red currants, etc. Barley was cut and stored by July 27th last year. The Fathers complained of a scarcity of hay grass, and were mowing coarse swamp grass five to six miles from the Mission."

"On the 28th July the journey was resumed, taking a north-west course from Fort Qu'Appelle, passing nearly midway between the Touchwood Hills and the River Qu'Appelle and its tributary, Long Lake."

See also *Appendix, Pac. Ry. Rep.*, 1879.

$\frac{50}{105}$ See Appendix, Pac. Ry. Report, 1879.

$\frac{50}{106}$ See Appendix, Pac. Ry. Report, 1879.

$\frac{50}{107}$ See Appendix, Pac. Ry. Report, 1879.

$\frac{50}{108}$ See Appendix, Pac. Ry. Report, 1879.

$\frac{50}{109}$ *Surveyor-General of Dominion Lands' Report*, 1880—*A. P. Patrick, D.T.S.*

Mr. Patrick thus describes the Indian Reserve at Forks of Red Deer and South Saskatchewan Rivers:—

"The land at and about the reserve is fair in several places, say about one-half would be fit to raise crops if irrigation were at all practicable, which I very much doubt. There are a very limited number of the bottoms, however, which might be farmed, but little or no wood is to be found except at the Forks."

After sending Mr. Nelson to Fort Walsh, I left for Fort McLeod. The soil from the point at which I finished work to the mouth of the Big Bow, is similar to that of the reserve, no wood.

Mr. Patrick's assistant, Mr. Nelson, travelled from the Forks south-westerly through this section on his way to Cypress Hills.

"While *en route* to Fort Walsh Mr. Nelson made an odometer survey of the road, and located the topographical features on the way. He reported the country between the South Saskatchewan River and Cypress Hills as broken by the Seven Persons' Coulée with its branches; the land improves as one approaches the hills, but the whole country is fit for pasture only."

See also Appendix, Pac. Ry. Report, 1879.

$\frac{50}{110}$ See section $\frac{50}{109}$ for Mr. Patrick's description.

See also Appendix, Pac. Ry. Report, 1879.

$\frac{50}{111}$ See Appendix, Pac. Ry. Report, 1879.

$\frac{50}{112}$ *Macoun Exploration*, 1879.

Mr. Macoun entered this section near the middle, on his way to the Blackfoot Crossing, passing south-westerly, and thus describes it: "The country is much drier this forenoon. Water very scarce. Stopped for dinner at Crowfoot Creek, which here consisted of a few muddy pools. Rolling hills with deep hollows between were the general features of the country. Stipa, Kloeria and Bouteoula are almost bunch grasses here. Driest country seen yet. For two hours after dinner kept down the creek, and then turned up a ravine to the right and attained the prairie level. Before turning away from the creek, which is here 30 yards wide, I noticed a ledge of rock crossing its bed, which, on examination, proved to be coal of excellent quality. The seam was six feet in depth, and seemed much deeper than the exposure. Brought an armful of it to camp and found it to be a first-class article. It burned with a clear flame, and in the morning was still aglow. Heaped a few more pieces on and it burned all day. The ash is quite white and no slaty cinders were left."

"Between the creek and the Blackfoot Crossing is a wide stretch of rolling prairie which would make good agricultural land if not too dry."

"Ogilvie measured the river at the crossing and found it to be 220 yards wide, with an average depth of 3½ feet, with a pretty strong current. We crossed it this afternoon (August 27th), and examined Mr. French's grain field. He informed us that the grain now ripe was sown a month too late, not being in until June 6th. Oats stood four feet high; barley was very good; but wheat was short in the straw, though the grain was very fine. His peas had been cut for some time and were now off the ground. The greater part of the field had been broken out of the prairie sod last June. He has also four acres of potatoes and two acres of other vegetables on the high prairie, six miles further south, and they are more than first-class. I had thought from the appearance of the grass that the climate was altogether too dry, but French says there is all the rain necessary to perfect the crops."

"Outside his field all was dry and parched; inside, where the soil was broken, the grass was green and luxuriant. Grass which outside bore no seed and was very short; in the ploughed field, vied with the grain in tallness."

"Numerous outcrops of coal occur at this point, and the coal has been burnt in stoves by Mr. French for two winters. The stoves used are the old-fashioned self-feeding ones. He speaks very highly of its heating qualities. The coal here occurs in connection with brown hematite as it did on Red Deer River."

"Much fine timber occurs in the river valley below the crossing, which, if cared for properly, will last for many a day. Not a bush or tree is to be found between the two rivers."

From the crossing, Mr. Macoun passed north-easterly along Bow River out of the section, and says:—

"Two miles over the valley brought us to the ascent to the prairie, which we found to be pretty sandy. We travelled for eight miles over this plain, with generally a rolling country on the right and a range of low sand hills on the left, which filled a large bend the river made at this point. After crossing the plain, we descended over 100 feet into a large valley, bounded on the right by the prairie bluffs, and far on the left by the river. Five miles over the plain brought us to camp on the river side. The river valley contains some fine timber (Balsam poplar and Cotton-wood) suitable for house building and for rails. The land at camp is excellent, and the whole country on both sides o the river is suited for agricultural purposes."

See $\frac{49}{113}$ for Mr. Patrick's description of this section.

See also *Appendix Pac. Ry. Rep.*, 1879.

$\frac{50}{113}$ *Macoun Exploration*, 1879.

Mr. Macoun passed north-westerly through the northern part of this section, on his way to Calgary, and states as follows :—

"Started late, and travelled through a very fine country for 16 miles. Soil sandy loam, of first-class quality; not an acre seen to-day unfit for the plough. We were never more than five miles from the river all day, and it could be seen meandering through its valley at all times. Its banks seemed to be about 60 feet high, with sandstone exposures in various places. For 11 miles beyond this we passed over the same description of country as yesterday, and then reached a depression, in which lay Long Lake, containing brackish water."

*Surveyor-General of Dominion Lands Report*, 1880—*A. P. Patrick, D.T.S.*

Mr. Patrick passed north-westerly through almost the whole length of this section on his way from Fort MacLeod to Fort Calgarry.

"On the 6th August, 1879, the whole party left MacLeod for Fort Calgarry. I made an odometer survey of the road. For the first thirty miles the land is not good, the soil being dry and light and unfit for farming, after which the soil improves materially up to Mosquito Creek, at which place I found a rich black loam on which good crops of any kind can be grown; feed here is good. From Mosquito Creek to High River the land continues to improve. From High River to Calgarry the road is intersected by six creeks and the soil is very fine; in fact, of a higher order than any I have seen in the North-West Territories. The country is most abundantly wooded at the creeks. In describing this portion of the North-West Territories, I find it difficult, if not impossible, to employ suitable terms in order to adequately express the fertility of the soil. The magnificent pasturage here found bears undeniable testimony in favor of the land; although at present this pasturage is its only production, it is nevertheless safe to predict that at no very distant date some of the finest farms in the whole Dominion of Canada will be located here. I know of no place where the resources and fertility of the great North-West make themselves more apparent. The creeks I have just mentioned abound with trout averaging from one to two and half pounds."

Mr. Patrick examined the country easterly from Fort Calgarry south of Bow River.

"I then left Calgarry for the purpose of making an odometer survey of the Bow River from that place to its mouth, a sketch of part of which I now enclose. At the mouth of Fish Creek, which is eight miles from Calgarry, down the Bow River, I laid out a Government farm, in accordance with instructions received from the Indian Commission. The farm is three miles in length and two in width; the land in this farm is equal to any I have previously mentioned. The Government Farm Instructor now there is very sanguine of raising large crops. It was most satisfactory to note that a settler on a farm immediately joining the Government farm has this year raised a crop which is perhaps greater than that obtained by any settler in the whole district; this settler has many improvements on his farm, including a good house, outbuildings and fences, &c., &c. From the mouth of Fish Creek to ten miles below High River, the land continues similar to that on the Government farm; from that point to the Blackfoot Crossing the land becomes inferior as we approach the Crossing, where it is light and dry. Wood is to be found at short distances on the Bow River, until the reserve is reached; here it is more plentiful. About ten miles from the mouth of High River we were overtaken by the extensive and destructive fire which swept the whole prairie; this prevented me from going to the mouth of Bow River, which I intended to do; I therefore went to Fort MacLeod.

The soil between the Blackfoot Crossing and the Little Bow is very inferior, and only fit for pasturage; from the Little Bow to MacLeod the land continues inferior, the pasturage, however, is fair."

See also *Appendix Pac. Ry. Rep.*, 1879.

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114 See Appendix, Pacific Railway Report, 1879.

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## FROM THE 100TH TO THE 115TH MERIDAN AND BETWEEN THE 49TH AND 50TH PARALLELS OF LATITUDE.

49

100 *Surveyor-General of Dominion Land Report*, 1880—*W. Pearce, D.L.S.*

Mr. Pearce travelled extensively through this section, and thus reports.

"The timber and undergrowth on the mountain (Turtle) were very dense, and in some places we encountered a network of lakes, in some of which there were islands, to which access was very difficult, as we had neither a boat nor a canoe, and no timber suitable for rafts was available.

A great deal of time was lost in getting across or around some of these lakes. Trails had to be cut out to enable the pack-horses to pass, the roads made by the Boundary Commission being so blocked by fallen timber or grown up with underbrush as to be impassable. Excepting Turtle Mountain, the the country was nearly altogether bare prairie.

It will be observed that this survey extends to range thirty-two west. It cannot be carried further west until the one hundred and second meridian is established. Had it not been for the prairie fires which, early in October, destroyed all the pasturage, the survey would have been continued for some time in Townships three and four west of Range sixteen.

Very little timber was met with excepting in Turtle Mountain, where it consists almost wholly of poplar; on the outskirts there is some scrub oak. In some places the poplar is of good size, especially along the meridian between ranges twenty and twenty-one, but it is generally small, very suitable, however, for fence rails and small log buildings. About one third of the mountain north of the International Boundary was burned over some six or seven years ago, and the timber totally destroyed. It is now covered with a dense growth of young poplar. Last autumn, shortly after this survey of this part was finished, the fires ran in from the prairie, and probably considerable timber has been destroyed. The soil generally is gravelly and stony, and unfit for cultivation. In some places, however, there is some very good farming land. About one-fourth of this mountain is covered with water—lakes, ponds, muskegs and a few very good grass swamps. Some of the lakes abound in fish, chiefly pike or jack-fish. All along the slope of this mountain there are, at short intervals of from one to two miles, spring streams which flow all summer. When these streams reach the distance of four or five miles from the timber, the evaporation is so great that they become dry during the hot weather. The water here is very sweet, and contains much lime. In some places springs are met with strongly impregnated with iron.

It would perhaps be advisable to reserve the greater portion of this mountain as woodlands, to be sold to the settlers on the adjoining prairie.

On the prairie portions embraced within this survey, the black loam varies from six inches to two feet in depth; the sub-soil is white clay, containing a large amount of lime. This sub-soil is very well adapted for grain growing.

There will be no difficulty to obtain good water in any place by sinking wells to a moderate depth. The North and South Antlers are splendid spring creeks. On the South Antler, for about twelve miles from its mouth, there is some timber, a belt two to six chains in width, chiefly elm, ash and maple. This stream is full of beaver dams, and abounds in beaver as far west as the north-west corner of Township two, Range thirty-two west. At this point it appears to have nearly as great a volume of water as at his mouth. Its source is many miles further to the north-west.

In some places, boulders in considerable numbers are met with, but apparfently all, or nearly all, lie on the surface, and when the land is once cleared o- those visible, cultivation will no longer be impeded, while the soil is such that should there be any lying a few inches below the surface, they will not be brought up by the frost, as is the case in heavy clay sub-soils. There are in very few places more stones on a quarter section than can be advantageously used for the buildings required on it by a settler.

It would be advisable to sub-divide the whole area embraced in the survey, not already divided, excepting, perhaps, Ranges thirty-one and thirty-two west, but even that block contains at least thirty per cent. suitable for cultivation. The remainder is very well adapted for pasturage, particularly for sheep.

In Ranges fifteen, sixteen, seventeen and eighteen the land is rolling and full of basins, varying in size from one to twenty acres. These basins, during wet weather, are ponds of water often several feet in depth, some of them, even in the dryest seasons: contain much water. To drain these would be expensive, necessitating ditches of great depth. On the summits of the knolls the soil is rather light, gravelly and stony. On the banks of the streams there is usually a margin of from one to five chains in width, so full of stones as to render ploughing impossible."

See also *Appendix Can. Pac. Ry. Rep.*, 1879.

Sections $\frac{49}{101}$ to $\frac{49}{109}$ are referred to in *Appendix, Pac. Ry. Rep.*, 1879.

$\frac{49}{110}$ *Surveyor-General of Dominion Lands' Report*, 1880—*A. P. Patrick, D.T.S.*

Mr. Patrick speaks generally of this section.

"From the Big Bow to Fort Walsh the country is unfit for farming, but the pasturage is fair. About Fort Walsh the land is by no means bad; in fact several practical farmers said they had every reason to anticipate good crops; summer frosts, however, are prevalent and the crops put in have not been successful. This year it was found impossible to raise potatoes but the oat crop was rather good. At Fort Walsh, in addition to the Police Fort and the two large trading posts of I. G. Baker and T. C. Powers, there are quite a number of settlers, say about thirty-five or forty. At a point known as the Four Mile Coulée, lying four miles north-east of Fort Walsh, is a small Half-breed settlement."

$\frac{49}{111}$ See section $\frac{50}{109}$ for Mr. Patrick's description.

See Appendix Pac. Ry. Rep., 1879.

$\frac{49}{112}$ *Suveyor-General of Dominion Lands' Report*, 1880—*A. P. Patrick, D.T.S.*

Mr. Patrick crossed this section westerly from the mouth of Big Bow River towards Fort McLeod.

"In crossing at the mouth of the Bow River, I should have experienced great difficulty had it not been for the assistance afforded me by some Blackfeet who happened to be camped there. The soil about the mouth of the Bow River, and as far as the crossing of the Little Bow, is exceedingly poor for farming purposes; the pasture is only fair. Beyond the crossing of the Little Bow the soil becomes slightly better, and wood more plentiful in the bottoms."

See also *Appendix, Pac. Ry. Rep.* 1879.

49

113 *Surveyor-General of Dominion Lands Report*, 1880 –*A. P. Patrick, D.T.S.*

Mr. Patrick crossed this section westerly towards Fort McLeod.

"At Fort Kipp, which is situated at the mouth of the Old Man's River, there is a particularly fine bottom of two or three thousand acres, on which there is a tolerable supply of wood. Between Fort Kipp and Fort McLeod the soil is of a similar nature; if it differs in any way, the change is for the better. About three miles below Fort McLeod, on the Old Man's River, a settler named MacFarlane has taken up a farm on which he has many improvements. The crops raised by him, which include both grain and vegetables, are very superior.

"Soon after my arrival at Fort McLeod, I made a survey of the Old Man's River, from McLeod to the Rocky Mountains, a sketch of which has been forwarded to the Department. About five miles above Fort McLeod there are some three or four farms on bottoms of the Old Man's River, the settlers upon which have succeeded in raising some very good crops, and are all perfectly satisfied with the result of their farming operations. Still further up the Old Man's River, and at a distance of about thirteen miles from McLeod, are three good farms; the crops there have been much the same as on the farms nearer the Fort. These three farms come within the Peigan Reserve, which I lately surveyed. There are two more farms still further up the Old Man's River, near the mouth of Pincher Creek, about twenty miles from Fort McLeod. The bench land between Pincher Creek and the Old Man's River is very fine indeed, and the soil rich, as is also the land from the south to the north branches of this river; between these forks the feed is above the average. The farm of the Mounted Police Force is situated on Pincher Creek, about seven miles from its mouth. The soil on this farm is good. The Indian farm, the site which was lately selected by Mr. Dewdney, Indian Commissioner, is situated about four miles south of the Police Farm, towards the Kootanie River. I have been informed that coal has been discovered there; the land is good, and, in my opinion, the selection has been a most judicious one."

Mr. Patrick surveyed the various rivers of this section and thus generally describes the country.

"In making the survey I found that the bottoms from the Forks of the Kootanie to the Forks of the Old Man's River were well adapted for farming; wood is plentiful; between the forks are three or four good farms. From this point down to the mouth of Belly River the bottoms continued fair, but there is a scarcity of wood. There is, however, coal to be found in many places; the best seam is that found at or near the colliery. A settler named Nicholas Sheran works a mine at this place, the coal from which is sold at Fort Benton, U.S., and also at Fort McLeod."

"The soil of the country passed over is very fine, both on bank and bottom, and is of a rich black loam similar to that of the Indian farm. At the mouth of Kootanie River there are two settlers who speak highly of the land they have taken up, on which they have raised good crops.

A few miles up the Belly River there is another settler, and on the Kootanie where it flows out of the Rocky Mountains there is still another, with a farm much similar to those already mentioned. The pasture all through this section of the country is very fine"

See also *Appendix Pac. Ry. Rep.*, 1879

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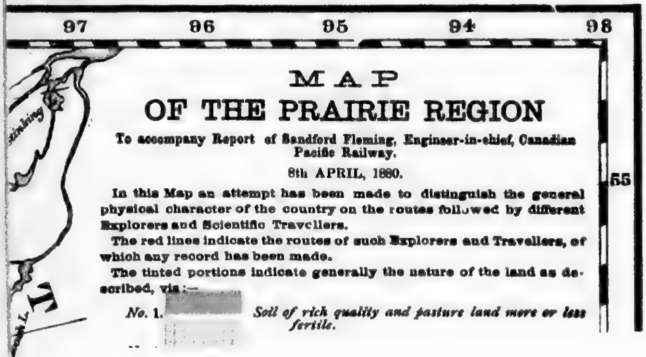
114 See Appendix Pac. Ry. Rep., 1879.

*any Report of the Engineer-in-Chief, Canadian Pacific Railway,* 1880.



# MAP
## OF THE PRAIRIE REGION

**To accompany Report of Sandford Fleming, Engineer-in-chief, Canadian Pacific Railway.**

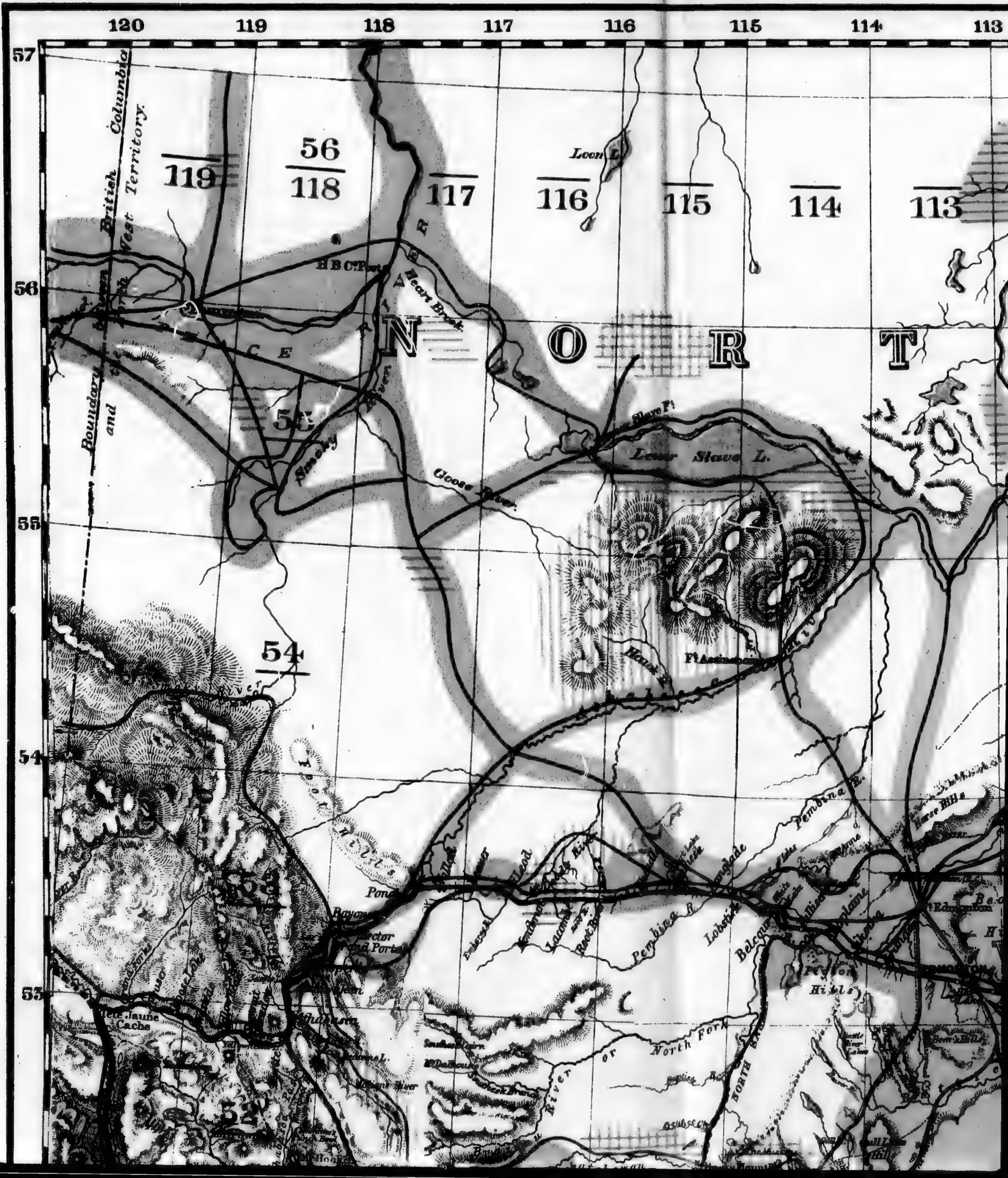
8th APRIL, 1880.

**In this Map an attempt has been made to distinguish the general physical character of the country on the routes followed by different Explorers and Scientific Travellers.**

**The red lines indicate the routes of such Explorers and Travellers, of which any record has been made.**

**The tinted portions indicate generally the nature of the land as described, viz:—**

*No.* 1. ▨ *Soil of rich quality and pasture land more or less fertile.*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Boundary between British Columbia and North West Territory.
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Loon L.
H.B.C. Post
Heart Brook
River
Peace
N O R T
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Smoky River
Goose River
Slave P.t
Lesser Slave L.
Ft Assiniboine
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River
Foot Hills
Pond
Macleod
Pembina R.
Lac Ste. Anne
Pembina R.
Horse Hills
Edmonton
Pembina R.
Lobstick
Belcourt
Root River
Lacombe
Peyton Hills
Tete Jaune Cache
North Fork
River or
NORTH
Bow's Hills
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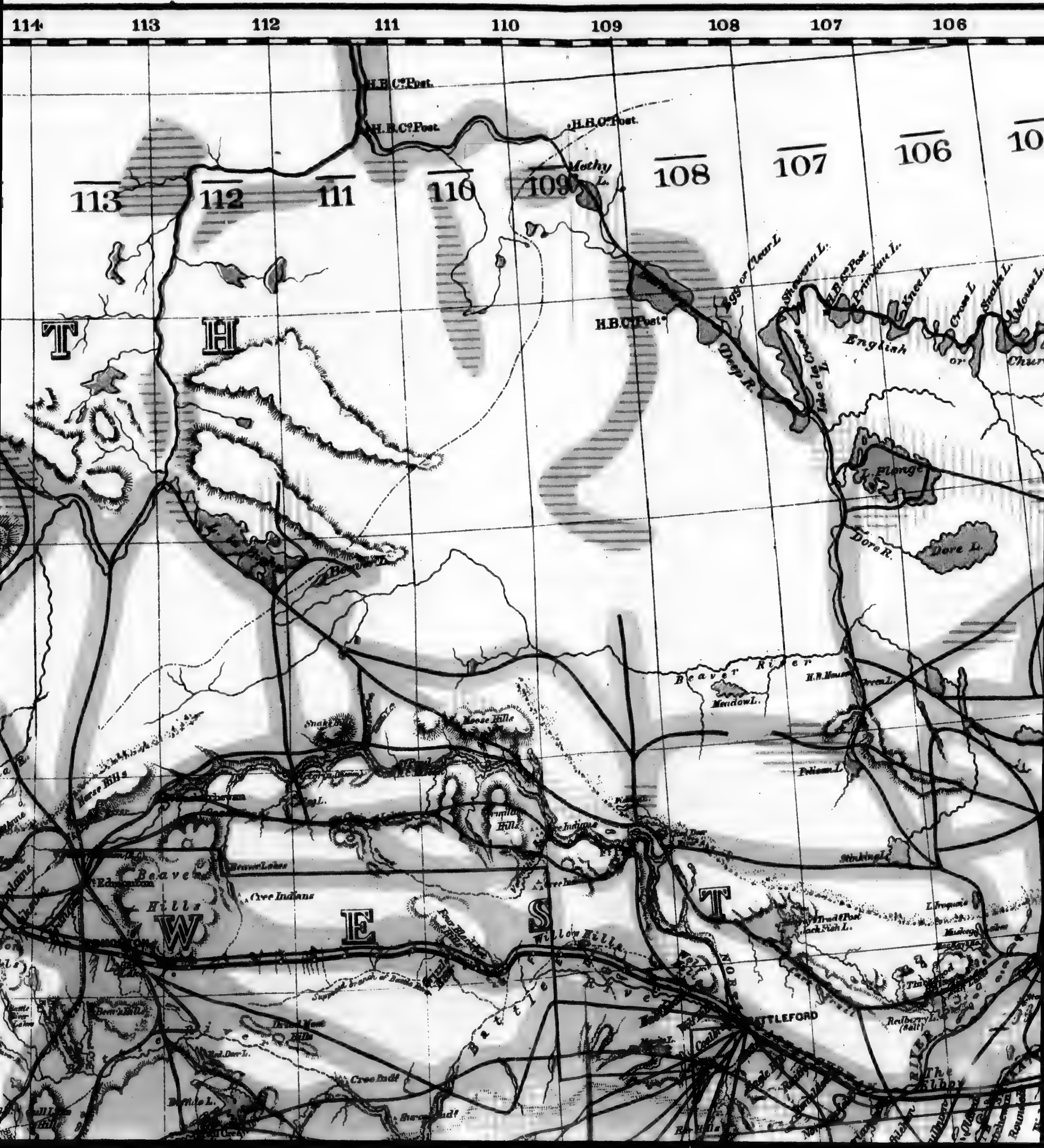
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H.B.Cº Post
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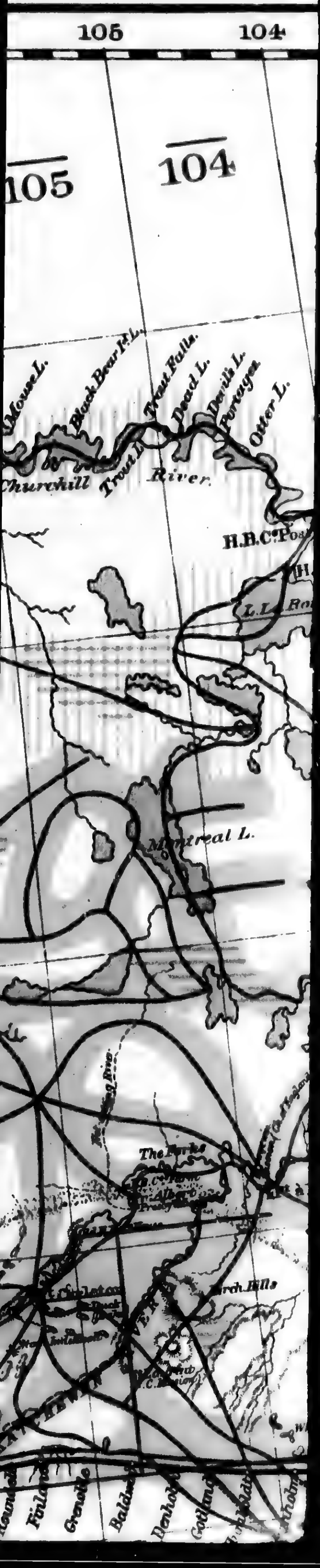
H.B.Cº Post
Methy L.
H.B.Cº Post
Egg or Clear L.
H.B.Cº Post
Primeau L.
Knee L.
Cross L.
Snake L.
Isle à la Crosse L.
Deep R.
English
or
Churc
L. Plonge
Dore R.
Dore L.
T
H
Beaver River
H.B. House
Green L.
Meadow L.
Pelican L.
Snake Hills
Moose Hills
Horse Hills
Stinking L.
Cree Indians
Edmonton
Beaver Hills
Beaver Lakes
Cree Indians
W
E
S
T
Willow Hills
Iroquois
Muskeg
Jackfish L.
Battle River
BATTLEFORD
NORTH
Thickwood
Redberry L. (Salt)
The Elbow
Cree Ind.
Red Deer L.
Buffalo L.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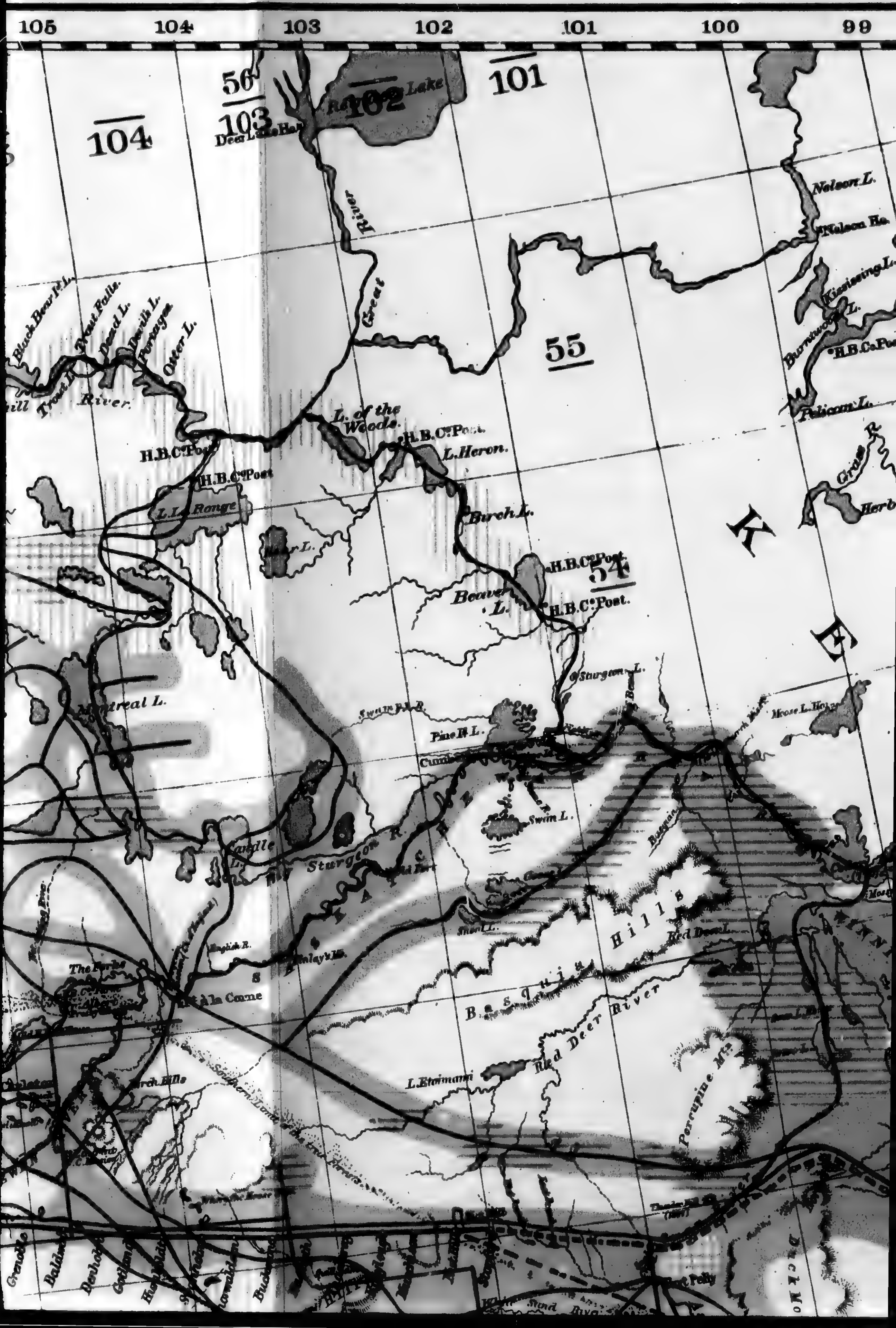
Mouse L.
Black Bear I. L.
Trout Falls
Dead L.
Devil's L. Portages
Otter L.
Churchill
Trout L.
River
H.B.C. Post
L. La Ronge
Montreal L.
The Forks
Birch Hills
Grenville
Baldur
Denholm
Gotham

Plate No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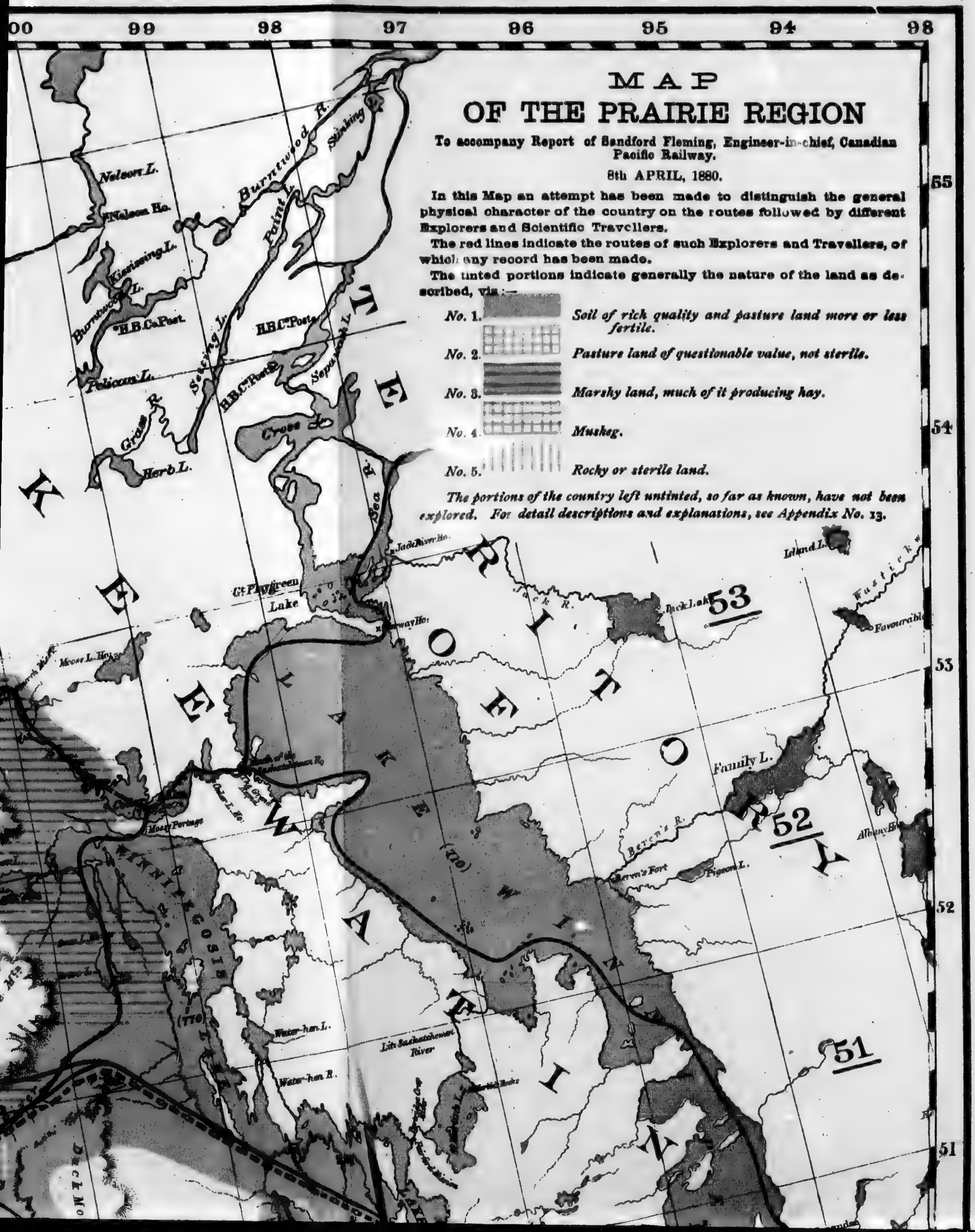
Deer Lake Ho.
Reindeer Lake
River
Great
Nelson L.
Nelson Ho.
Kississing L.
Burntwood L.
H.B.Co. Post
Pelican L.
55
Black Bear I. L.
Trout Falls
Dead L.
Devil's L. Portages
Otter L.
Trout L.
River
L. of the Woods
H.B.C. Post
L. Heron
H.B.C. Post
H.B.C. Post
L. La Ronge
Birch L.
Beaver L.
H.B.C. Post
54
H.B.C. Post
K
E
Grass R.
Sturgeon L.
Swan R.
Pine I. L.
Cumberland
Moose L. Ho.
Montreal L.
Swim L.
Candle L.
Sturgeon R.
Hills
Red Deer L.
English R.
The Forks
à la Corne
Basquia
Red Deer River
L. Etoimami
Porcupine Mts.
Birch Hills
Thunder Hill
Duck Mo
Grenville
Baldur
Denholm
Gotham
Buchanan
Pelly

**Plate No. 7.** *To accompany Report of the Engineer-in-Chief, Canadian Pacific Railway,* 1880.



# MAP
# OF THE PRAIRIE REGION

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8th APRIL, 1880.

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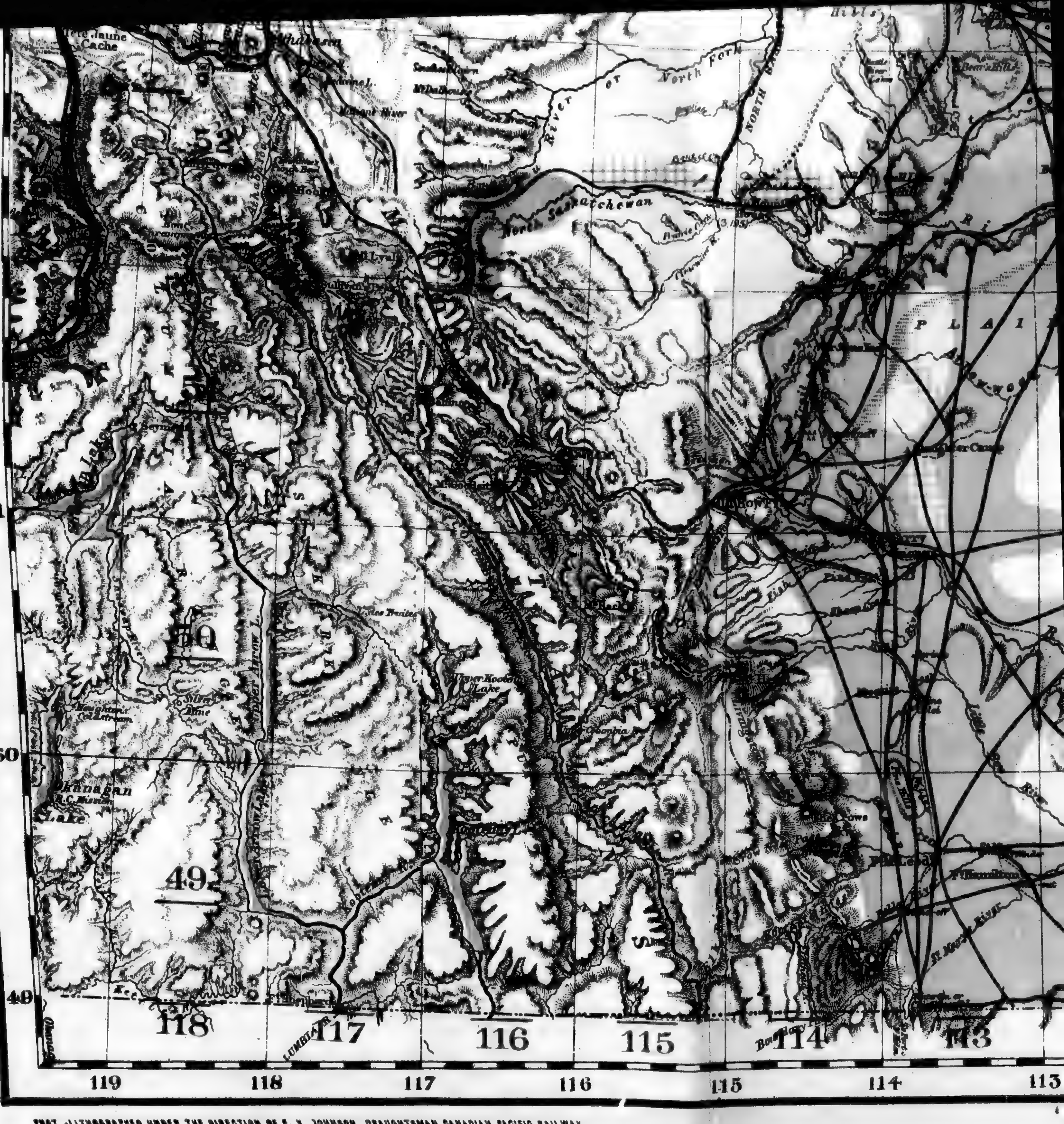
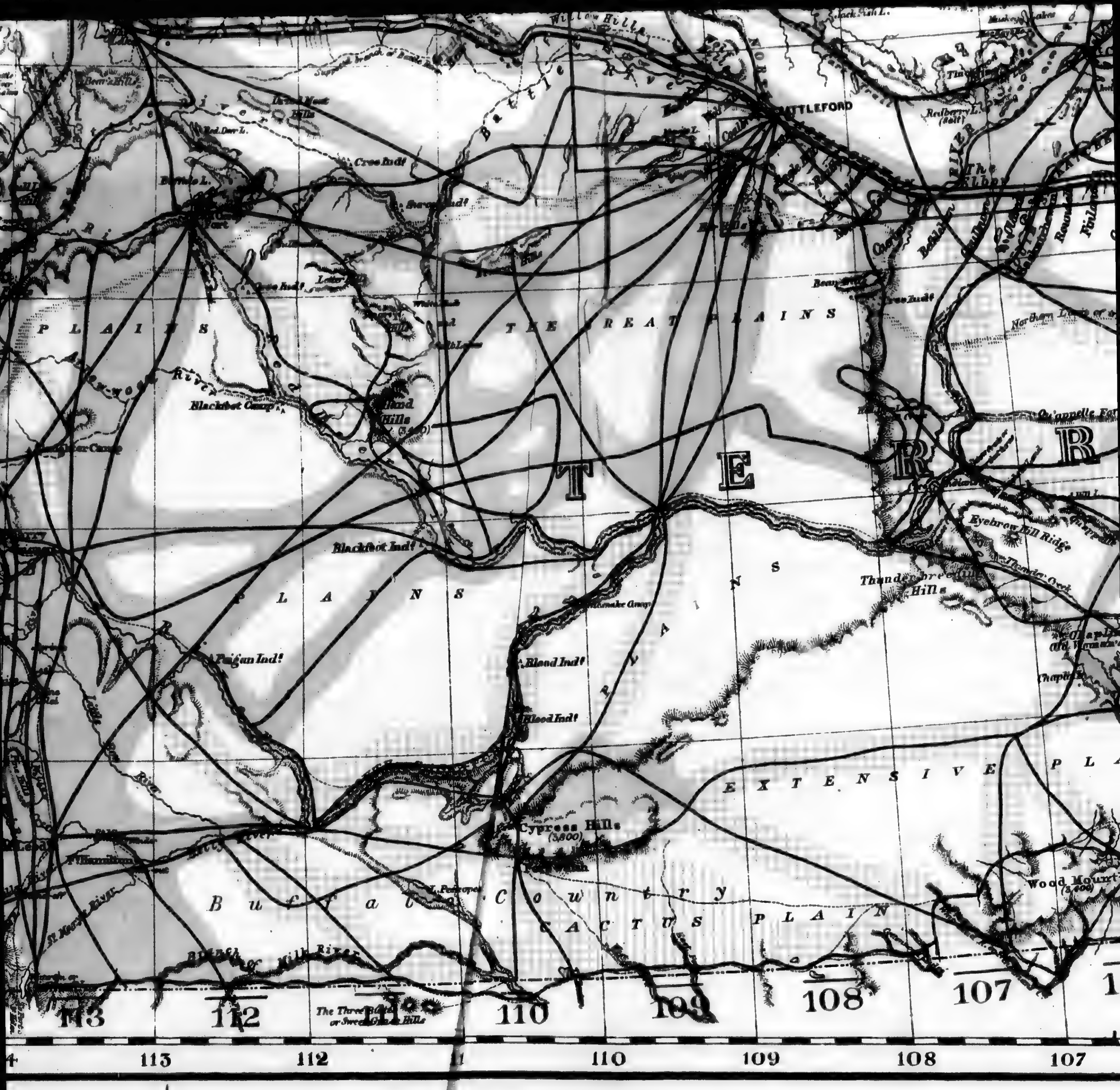
**The tinted portions indicate generally the nature of the land as described, viz :—**

| | | |
|---|---|---|
| *No. 1.* | ▨ | *Soil of rich quality and pasture land more or less fertile.* |
| *No. 2.* | ▦ | *Pasture land of questionable value, not sterile.* |
| *No. 3.* | ▤ | *Marshy land, much of it producing hay.* |
| *No. 4.* | ▦ | *Muskeg.* |
| *No. 5.* | ▥ | *Rocky or sterile land.* |

*The portions of the country left untinted, so far as known, have not been explored. For detail descriptions and explanations, see Appendix No. 13.*

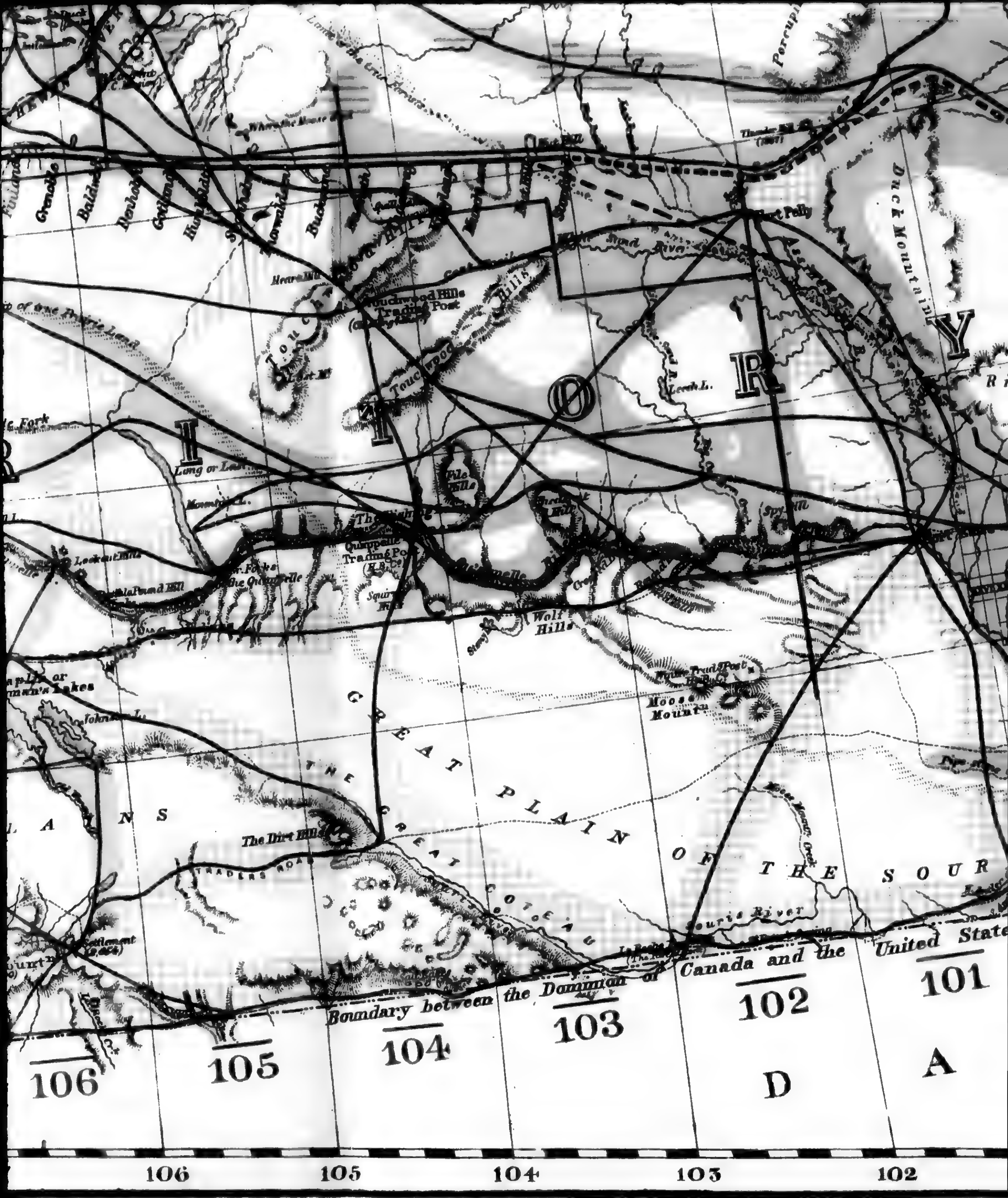


PHOT.-LITHOGRAPHED UNDER THE DIRECTION OF E. V. JOHNSON, DRAUGHTSMAN CANADIAN PACIFIC RAILWAY.

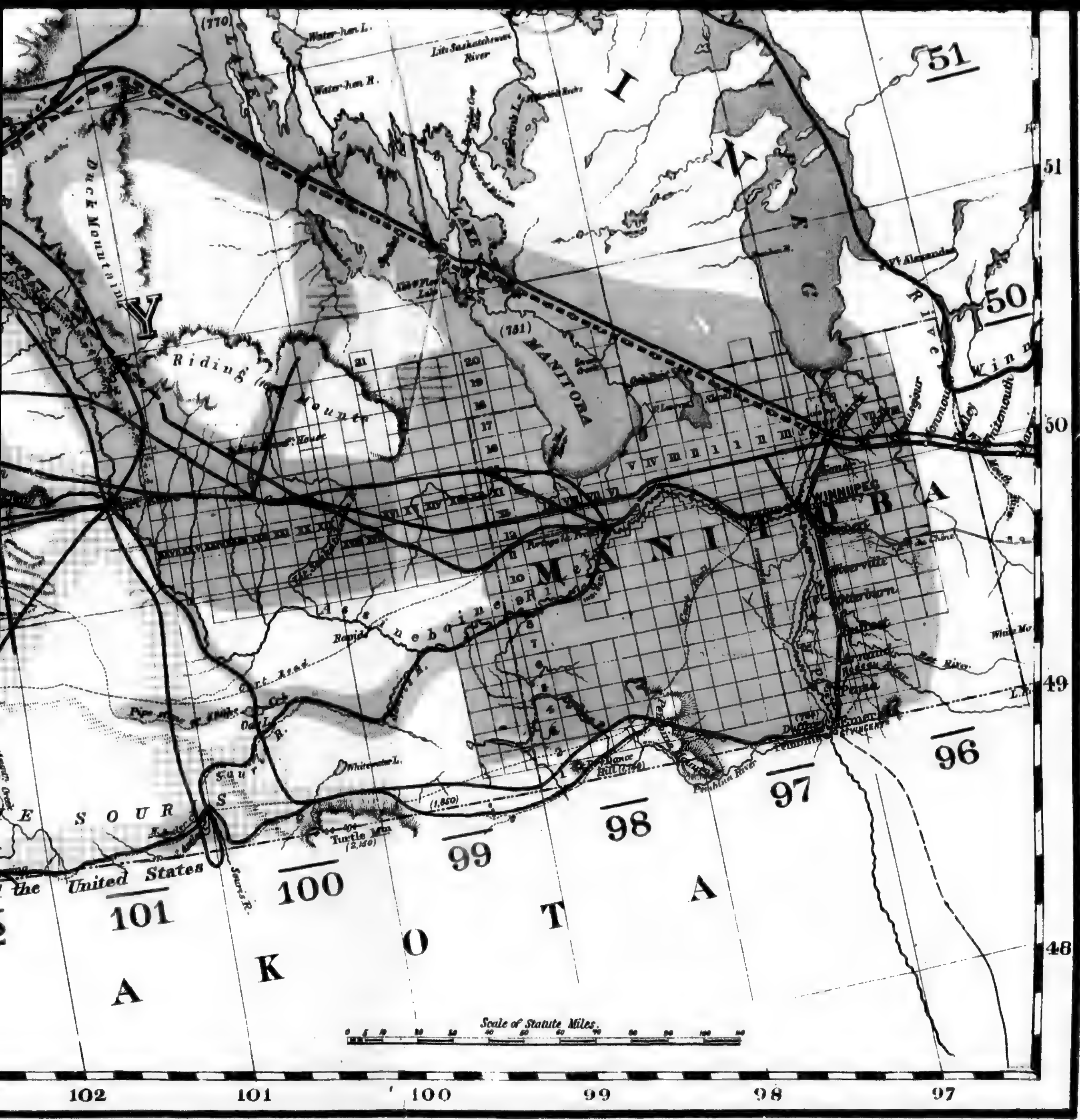


Willow Hills
Battle River
BATTLEFORD
Redberry L.
Cree Indt
Buffalo L.
Red Deer L.
Blackfoot Camp
Hand Hills (3,400)
THE GREAT PLAINS
PLAINS
T
E
R
R
Qu'appelle
Eyebrow Hill Ridge
Thunder Creek
Thunder breeding Hills
Blackfoot Indt
Piegan Indt
Blood Indt
Blood Indt
Cypress Hills (3,800)
EXTENSIVE PLA
Wood Mount (3,400)
Buffalo Country
CACTUS PLAIN
St. Mary's River
Milk River
The Three Buttes or Sweet Grass Hills
113
112
111
110
109
108
107
113
112
111
110
109
108
107

Birch Hills
Finlayson
Grenville
Baldwin
Denholm
Gotland
Humboldt
Long or Last Mountain L.
Lookout Hills
Moose Jaw Bone
The Forks of the Qu'appelle
Maple or Chapman's Lakes
Johnstone L.
L A I N S
The Dirt Hills
Traders Road
106
105
106



Line of the true Fertile Belt
Whitesand House
Grenville
Baldwin
Denholm
Gotland
Humboldt
Swanson
Buckland
Touchwood Hills
Touchwood Hills Trading Post
Heart Hills
Last Mt.
Fort Pelly
Duck Mountain
Assiniboine R.
Porcupine
Long or Last Mountain L.
Lookout Hills
The Forks of the Qu'appelle
The Fishing Lakes
Qu'appelle Trading Post (H.B.Co.)
Qu'appelle R.
File Hills
Squirrel Hills
Wolf Hills
Spy Hill
Leech L.
Moose Mountain
Moose Mountain Trading Post
Maple or Chapman's Lakes
Johnstone L.
L A I N S
The Dirt Hills
Traders Road
GREAT PLAIN OF THE SOURIS
THE GREAT COTEAU
Souris River
Moose Mount Creek
T O R Y
Boundary between the Dominion of Canada and the United States
106
105
104
103
102
101
D A
106
105
104
103
102



THE BURLAND LITHOGRAPHIC CO. MONTREAL

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113

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11

## APPENDIX No. 14.

### GENERAL REMARKS ON THE LAND, WOOD AND WATER OF THE NORTH-WEST TERRITORIES, FROM THE 102ND TO THE 115TH MERIDIAN, AND BETWEEN THE 51ST AND 53RD PARALLELS OF LATITUDE, BY JOHN MACOUN, F.L.S.

BELLEVILLE, 26th February, 1880.

DEAR SIR,—

The agricultural resources of the country explored are, beyond question, very great, and a general review of them, in connection with the various sections traversed, may be of value. My instructions were to explore "The tract to the south of the line located for the railway west of Livingstone and north of the 51st Parallel of Latitude, embracing all that portion of the country not previously examined within these limits west of the Assiniboine River and east of the Rocky Mountains." In all about 600 miles from east to west and on an average of 100 miles from north to south, in round numbers 60,000 square miles, or about 38,000,000 acres of land.

That section lying west of the 102nd Meridian, bounded on the south by the Qu'Appelle, on the west by Long Lake, and by a line extending north-easterly from the head of Long Lake to Quill Lakes, may be said to have both as regards surface and subsoil a similarity of character varying in degree from deep black clay loam, with a light colored marly clay subsoil, to a light sandy or gravelly loam with a gravelly subsoil. Throughout it is fertile, but not all uniformly rich, small tracts being met with having a large percentage of sand and gravel in both surface and subsoil. Some travellers, taking the washed subsoil thrown out by badgers or found in cart ruts as the real soil of the prairie have, characterized parts of this region as gravelly and sandy, but pits dug into the subsoil of that particular locality showed but a small percentage of either. Within the last year, settlers west of the Little Saskatchewan have fully borne out my former statements on this point, and found first-class soil where surveyors called the land second-class, or gravelly.

Abundance of good water is found on every part of this tract for the greater part of the summer, and future settlers will find that good permanent wells will be obtained at a reasonable depth on any part of the prairie.

Poplar wood for house building, fencing and firewood can easily be procured at Pheasant, File and Touchwood Hills, which extend from south east to north-west through its whole extent. Almost continuous woods extend along the Carlton road from 12 miles east of its western boundary to where the Qu'Appelle and Pelly road crosses it. Thence, eastward, extends the Pheasant Plain, a stretch of 25 miles along the road, without wood, but Pheasant Hills, having abundance of it, are always in sight. East and north-east of this plain, copse wood is more or less abundant until the Assiniboine is reached. West of the wooded hills spoken of, no wood exists, but the soil is of the very best description.

A depression, of which Long Lake partly fills the southern end, extends up to Quill Lakes, and although less than 12 miles wide where it crosses the travelled road from Carlton, gives the name of "Great Salt Plain" to a track 30 miles from east to west. This valley contains many lakelets of brackish water, and an alkaline creek which crosses the plain seems to discharge the surplus waters of Quill Lakes into Long Lake. In this depression no wood is found. In fact not a bush, as far as known, grows on a belt of country 25 miles wide, extending from the Qu'Appelle to Quill Lakes.

Proceeding westward between this valley and the South Saskatchewan a large tract extends from the head of the Qu'Appelle to the located railway line. On its southern border it is bounded by sandhills which commence on the east side of the Qu'Appelle, near Sand Hill Lake, and cross that river at its source, then stretch westerly to the South Saskatchewan, crossing that stream a few miles south of the Elbow, and then apparently turning north, disappear near the discharge of Red Deer Lakes. North of this line of sandhills, east of the Saskatchewan, the ground is quite arid, having been very much parched during the last season by the middle of July. This dryness, however, is merely local. I believe it to be caused by the radiated heat, from the sandhills, rising and dispersing the clouds and preventing their moisture from falling in rain on the parched earth. Although no rain fell on this tract while we were there, it rained to the north and east of our camp every day. A few miles north of the hills this dryness disappears and an unbroken prairie covered with excellent grass extends for many miles, eventually passing into poplar woods that extend right up to the located line of railway. Sandy loam, becoming lighter as the river is approached, is the prevailing surface soil of the country.

Between the South Saskatchewan and the Third Prairie Steppe is found a tract of land varying much in character. Proceeding north-westward from the Elbow a range of sandhills is crossed, then a fine rolling prairie, succeeded by low hills covered with the best soil, and producing fine grass, suitable for hay. In these hills lies the valley containing the Red Deer Lakes. Passing west a plain consisting of friable clay extends for 25 miles to the base of the Steppe. Abundance of good water is to be had, except on this plain, but its grasses show that water cannot be far from the surface, as Wild Foxtail (*Alopecurus aristulatus*) and Fowl Meadow Grass (*Glyceria nervata*) being both grasses peculiar to wet soil, were quite frequent. On digging into the clay, the roots of the grasses were found to penetrate to a great depth, the soil being literally filled with them.

A small range of sand hills were seen north-west of Red Deer Lakes, containing some small poplar and thickets of various kinds of brush wood, but on every side it melted into the plain, and the brush and trees disappeared with the sand. Around these hills were a number of brackish lakes and marshes and were doubtless a part of those observed by Palliser in 1857. North of these Palliser had seen a very fair country, with some copse wood, which, as he proceeded north, passed eventually into forest. Between the Bear and Eagle Hills, on the west, and the South Saskatchewan, on the east, the soil is generally a light, sandy loam, with numerous fresh water ponds and brackish lakes and marshes. Copse wood is found, but the trees are small in size and the quantity is constantly decreasing. The valley of the Saskatchewan contains more or less timber on both sides of the river in its immediate neighborhood.

Palliser, in speaking of the country at the Red Deer Lakes, and south of them, says :—"After leaving our dinner encampment, water was very scarce, many of the temporary swamps being quite dried up, and after a long search we were forced to encamp at a dirty water hole, from which a band of buffalo cows fled at our approach. Being at some distance from the river, also, our fuel was buffalo dung, of which there is no lack in this part of the country. The soil here is quite arid, and the herbage on the plains nearly worthless." At Red Deer Lakes he finds "buffalo very numerous," and the grass so "eaten down that their horses had hardly any food." He also speaks of the country being literally full of deer, such as "elk, black tail deer, common deer and Forcifer antelopes." When I saw this country, that which brought the deer and buffalo there, remained, viz.: An exuberant vegetation, but not a live animal existed; where Palliser could not get grass for his horses, we could scarcely get through for its luxuriance. I presume, therefore, that, owing to the grass having been cropped off by the enormous herds of buffalo which ranged the country in Palliser's time, he received the impression that the country was arid and the pasture worthless.

The Bear Hills, which seem to be a continuation of the Côteau, have been already spoken of in my journal. It may be further remarked, however, that these hills contain a large quantity of fine arable land, besides numberless hay marshes. Ponds of fresh water are constantly met with in the hills, and brackish marshes and lakes are numerous along their flanks. The Bear Hills pass gradually into the Eagle Hills which, at first, turns to north-east, but, as they approach the North Saskatchewan, they trend to the north-west and continue in that direction until they reach Battle River, some distance west of Battleford. At Battleford their base is about eight miles south. As they pass eastward they draw nearer to the Saskatchewan. Their northern slope, is a continuous forest of very good poplar (*Populus tremuloides and balsamea*) which breaks up and becomes interspersed with prairie as it approaches that river. Between Battleford and Eagle Creek no less than 22 small streams issue from the forest and make their way into the river. Owing to these streams, the country between the hills and river is very much cut up and rendered well nigh impassable for loaded carts when the hills are wet and slippery.

The land bordering on the river is generally a sandy loam, but many fine farms will yet be located there. In the hills themselves, and southward from them, the land is very rich, the soil being a black clay loam, changing as it gets drier (southward) into a sandy one, but with little change in vegetation. Mr. Wilkins crossed diagonally through the hills, while I passed on both sides of them, and his report of the land at the Mission and at the Government Farm agrees with my own observations. The land in the southern extension of the hills is very much broken and contains multitudes of ponds and fresh water marshes where immense quantities of natural hay of the very best quality goes to waste every year. Although many people think the hills the best for settlement, I believe future settlers will prefer the prairie as there is less broken land, less marsh and swamp and less labor required to make a home.

The Great Plain is not easily described, except in general terms, owing to its immense size and changing character. By referring to the journal it will be seen that Mr. Wilkins met with first-class grass, plenty of water and good clay or clay loam soil, until after he passed the 111th Meridian. Coming from Battleford, I found excellent grass, plenty of good water, and a rich loam or clay-soil until I passed some distance south of Lat. 52° and west of the same meridian. We both noticed the change from a good strong clay, producing excellent pasture, to another clay covered with Artemisia and small Cactus where the water was scarce and bad and the pasture poor and dried up. On examination, this clay proved to be the Cretaceous St. Pierre beds of Dr. George M. Dawson's Boundary Survey Report, and contains remains of Baculites and other fossils, together with nodules of brown iron ore. This tract of bad land is principally confined to the section between 111th and 112th meridians, and between the 51st and 52nd parallels of Latitude. Except this region, the Great Plain, as far as known, is not arid, but produces good grass, has generally abundance of water and usually a good soil. This extensive tract is almost wholly without wood of any description. Not a shrub enlivens its surface, except occasional clumps of rose bushes (*Rosa blanda*) a few inches high. The western Snow berry (*Symphoricarpus occidentalis*) and the beautiful Silver berry (*Elæagnus argentea*). These could not be called bushes except that they were woody. They were never seen more than three years old and hardly ever that. The couleé, in which Tramping Lake lies is still partly wooded with poplar and maple, but except this and a few other localities not seen by me, no wood exists.

Coulèes are quite a marked feature of the plains, but do not appear to be a part of the present natural system of drainage. They seem to be of an earlier geologic time, other than being dry water-courses of the present; and here the few creeks, which carry off the surplus water, originate. The Qu'Appelle Valley is a well-known instance, the valley in which the Red Deer Lakes lie is another. Crawling Valley, between Red Deer and Bow River, is a third, and here on the Great Plains is a fourth, as Tramping Lake Coulêe, is said to be the head of Eagle Creek on the one side and a stream emptying into Battle River on the other. As a rule, the lakes found in the coulées are salt, but this is easily accounted for, as their bottoms are always on the Cretaceous clay, and the springs near the bottom of the coulée are brack ish likewise, while the springs nearer the prairie level contain good sweet water. All brooks found on the plains, although containing good water themselves, have saline soil along the sides of their valleys, and not unusually brackish lakes and marshes in them.

Extending northwardly from the vicinity of the Bear Hills is a tract of broken country with deep coulées, salt lakes and occasional sand hills which seem to extend westward to Tamping Lake. Much of the soil, however, is very rich, and there are large tracts of farming land intermixed with small areas of a broken and stony character. Captain Palliser's remark of this country being barren can only apply to the absence of wood, as he speaks again, on Page 54 of his Report, thus: "The buffalo were seen in great numbers," and that "the country was entirely barren;" and again, on the same page, he says, "we found only a swamp containing miserable herbage, which had been cropped by the buffaloes and afforded very scanty pasture for our horses." Here, again, I presume that the barrenness is not produced by natural causes, but by artificial ones.

A perusal of my own journal, and that of Mr. Wilkins, will show that this region, although not every where suited for agriculture, possesses many fine tracts fit for the plough, and always good pasture. In the Pacific Railway Report of 1879, page 90, Col. MacLeod well describes the section he saw. He says: "The whole country is a high rolling prairie with gravelly ridges running in every direction. Grass of varying quality is to be found everywhere, and water varying with the season." Captain Dalrymple Clarke, in the same Report, says: "I should call the Great Plains a fine grazing country; in many places the traveller comes across buffalo or bunch grass. This grass is most nutritious and always preferred to other grass by both horses and cattle." With the statements of these gentlemen, I entirely agree, and, furthermore, affirm that as this same region was the winter home of the buffalo, so in the near future will it be the winter home of immense herds of cattle, which can exist, as they did, by going unto the wind swept hill tops for nutritious food, when the poorer grass of the valleys lies covered by a mantle of snow. Water for cattle no more than for buffalo is needed in winter, as there is always snow enough among the grass to meet their wants. After the first of October our horses went to the hill tops for good grass, and I found, on examination, that they always cropped the northern buffalo grass (*Stipa spartea*), or if the hill was very dry, the southern one (*Bouteloua oligostycha*). I must emphatically deny the statements made imputing barrenness to this region, but admit that running streams or cool springs are extremely rare. Wood is absolutely absent, and even a bush a few inches high is seldom seen.

The real cause of the absence of wood on every part of the region under consideration is undoubtedly prairie fires which sweep over almost every part of it year after year, destroying the seedling trees as long as there are any seeds left to germinate, and year by year killing the bushes until the capacity, of the root to send up shoots, dies out and even willows cease to grow. Would any person affirm that willows could not grow on the margin of the ponds where such plants as Polygonum aquaticum, Potamogeton perfoliatus and gramineus, Utricularia vulgaris, Alisma Americana and Sagittaria variabilis could grow and flourish? And yet the first four of these were found in scores of ponds, and any botanist knows that these require permanent water. It was so moist on the plains that no Cacti could exist, but in Red Deer River Valley a person could hardly walk through it for them, yet on the plains not a bush could be seen, while in the valley, only a few yards from the Cacti, trees three feet in diameter stood.

Palliser states that the southern sides of all valleys were much moister than the northern, and that the southern slopes of all hills were without wood, and deduces from this the aridity of the climate. I am inclined, with all respect, to differ from Capt. Palliser in this conclusion. It only proves that a surface inclined to the sun will naturally become dry, while one inclined from it will retain its moisture. When fires come on the plains the dry side of the hill is soon denuded, while the moist side is left intact. The inference is plain. If aridity is the cause of the absence of wood, how is it that the sandhills at the head of the Qu'Appelle, where the ground is certainly dry, are covered with wood? The Bad Hills, to the north-west of Red Deer Lakes, have wood likewise, while the Bear Hills, to the north, which contain no sand, are without even a bush. The sand hills observed by myself and Mr. Wilkins in the centre of the great plain have brush in some quantity, while on good soil none exists. Finally, there is not a series of sand hills thoroughout the country, no matter how poor the soil but which has either wood or brush, while immense tracts of first class soil is without a bush The rich soil with its abundance of grass affords, when dry, fuel for the flame, which destroys any seedling that may spring up, while the sand hills, being unable to carry fire through their extreme poverty, save it alive.

Popularly, sand and aridity are classed together; instead, it should be sand and unfruitfulness. It is impervious clays that are arid throughout the region explored by me. A comparatively small tract, commencing at Red Deer River, east of Blood Indian Creek, about the 111th Meridian, extending north westerly to near the 52nd Parallel, and thence west to the Red Deer River, south of the Squirrel's Head, is largely a region of impervious clays, and was the worst tract seen by me or my assistant last summer. Much of this tract is without drift, and the Cretaceous clays come to the surface, causing aridity, and producing alkaline swamps (white mud swamps), ponds and lakes in abundance.

The Hand Hills and their eastern extension are like an oasis in this unpromising region, for surrounding them on every side is the hard baked clay of the St. Pierre beds. The only soil throughout the region explored which would not naturally produce timber are these Cretaceous clays, which are certainly "Bad Lands."

I, therefore, make the aridity where it exists one of soil and not of climate. Palliser, on Page 11 of his Report, when writing of this region, makes two statements corroborative of this. Describing the valley of the South Saskatchewan, Palliser says:—"Even on the alluvial points in the bottom of the valley, trees and shrubs only occur in a few isolated patches. The steep and lofty sides of the valley are composed of calcareous marls and clays that are baked into a compact mass under the heat of a parching sun. The Sage and Cactus abound, and the whole of the vegetation bespeaks an arid climate." Eight lines below this, on the same page, he says:—"In the midst of the arid plain traversed by the South Saskatchewan, there are isolated patches of table land, upon the surface of which the vegetation becomes luxuriant, and pasture of a fair quality may be found. The expedition spent two weeks at the Hand Hills, which form one of those patches, for the purpose of recruiting the horses."

Here the natural order of things is reversed, and aridity is in the valley and luxuriance on the hill-tops. Why is this? Not because of climate, certainly, but on account of soil. All the arid spots, all the salt lakes and the brackish marshes of the entire plain were traced to one cause—the Cretaceous clay.

Artemisia cana seems to be almost peculiar, on our plains, to the Cretaceous clay, and in the north the Cactus can only find on it that aridity of soil suited to its wants. The vegetation of these clays, when dry, outside of stream valleys, was characterized by numerous species of Artemisia, and many Compositæ, which in the north preferred salt lands. In Red Deer River valley, Cacti, Artemisia and various Chenopodiaceæ vied with each other in luxuriance, while grass and the more useful herbaceous plants were almost entirely absent.

Between the Red Deer and Bow Rivers, on the line crossed by us, the land was generally good, and that, for some distance on both sides of us, was said to be of the same character.

Taking Bow River as a base line, the country from at least ten miles east of the Blackftoot Crossing to 20 miles west of Calgarry, is nearly all fit for the plough on both sides of the river. As the Mountains are approached the country becomes broken, and we pass into the very finest pasture land on the continent. Sheltered valleys, clear spring brooks, dry, exposed hill-tops and excellent grass everywhere, seem to be the chief features of the country around Morleyville, and for 40 miles north. All parties agree in stating that the country south of the river was the same as I saw north of it.

From Morleyville, on the south, to the located line of railway, on the north, a distance in a straight line of 150 miles, the country was found more or less covered with willows and the remains of a former forest. A very high country extends from Dream Hill, near Morleyville, northward, being the source of Arrow Wood Creek, on the one hand, and the streams flowing into the upper part of Red Deer River, on the other. The valleys of these streams are generally without much wood, but abundance of willows and tall growing herbaceous plants make the country nearly impassable for carts. The soil is exceedingly rich, and the ground rolling, but not rising into abrupt hills.

From where Red Deer River and its tributaries issue from the Rocky Mountains, the country is more or less wooded until the river crosses the 52nd Parallel. All the land along the river is well suited for settlement, and many exceptionally fine locations for settlement were seen, and others heard of. At Tail Creek the land is very rich, but buffalo meat being so plentiful in the past the Half-Breeds have not turned their attention to agriculture. Here a fine settlement will spring up in a few years.

Between the forest line, on Red Deer River, and Calgarry, on the south-west, and the Blackfoot Crossing, on the south-east line, lies a more or less fertile plain. Along the river the land is said to be dry and often stony, but as it stretches westward it improves, and passes insensibly into the rich black loam seen by us as we came over the plain from Morleyville.

Battle River rises in a marshy country west of the 115th Meridian, and flows through a region chiefly second-growth forest until it crosses the 113th. Along this part of its course the banks are not high, but become more elevated as it flows eastward. Willow brush and poplar copse, with more or less prairie, cover the plain, which is gently undulating, but never rising into high hills. The soil here is chiefly a rich sandy loam, containing much dark colored sand, and carries such a crop of grass and vetches that we could scarcely force ourselves through. Passing the meridian of Hay Lakes, the soil gets drier, contains less sand, and the willows prefer the margin of the ponds. The whole of that section included between the located railway line and Battle River may be characterized as a gently undulating plain with a slight dip to the south. Water is scarce on this plain in the autumn. Wood in the southern part is not plentiful.

South of Battle River, and east from Bull and Red Deer Lakes, the country is rich but often broken by coulées, and the grass is always good. North of "The Nose" and the Neutral Hills I found a section of poor sandy soil nearly 25 miles wide. This tract cannot extend very far north, as Palliser, who crossed about ten miles north of my line, does not speak of it. With this exception, and the sand hills bordering the river near Battleford, all the country east of Battle River is first-class pasture or farming land.

In conclusion, all the land embraced within the limits of my exploration, except the sand hills at the head of the Qu'Appelle, and a strip of dry country north of the "River that Turns," a few square miles of sand hills west of the South Saskatchewan at the Elbow, a few more in the Bad Hills, and the dry arid region around the Hand Hills, and in the valley of Red Deer River, in their vicinity, is either fit for the plough or first class pasture. I am quite safe in saying that 80 per cent. of the whole country is suited for the raising of grain and cattle, and would not be the least surprised if future explorers formed a more favorable estimate.

Only two points in the country explored were noted where it was probable the rainfall was too light for successful raising of cereals, viz: At the Elbow of the South Saskatchewan, and the Blackfoot Crossing, but this view is, to a large extent, disproved by the experience of Mr. French, who had farmed in the latter locality for two years. He says that breaking the soil shows at once that the rainfall is quite sufficient. While the grass was entirely burnt up outside of his fence by the last of August, inside, where the land was broken up, many grasses and other plants were three times as tall as those of the same species outside on the prairie. The whole question then resolves itself into one of soil, as at the most southern point reached by me, the rainfall has proved quite sufficient, during two years, to bring all kinds of grain to perfection.

### WATER SUPPLY.

For years the water question had been a prominent thought, and during my journey of last summer I paid much attention to it, as many remarks in my journal will testify. Every salt lake, from the Riding Mountains westward, was found to have a hard gravelly bottom, and a careful examination revealed the fact that all were in depressions in the drift with their bottoms in Cretaceous clay which is known to underlie the whole country. These lakes are fed partly by water running on the surface, but principally by springs issuing from Cretaceous clay close to the water. All the lines of salt lakes throughout the country will be found resting on these clays. Salt Lake, 10 miles east of Shoal Lake, is a case in point. On one side of the road is the lake surrounded by a pebbly beach, on the other side, higher up, is a fresh-water pool from which all travellers get their supply. Now, it may be set down as an axiom that all water in pools surrounded by mud is fit to drink, but that, at certain seasons, at any rate, those ponds with a bare gravelly margin should be shunned. Good water can be obtained, in my opinion, anywhere in the drift, but as soon as the Cretaceous clay either crops out or is reached by digging, poor, if not very bad water, will be found. This accounts for McKernan getting bad water at Hay Lakes when he sank through the drift and penetrated into the Cretaceous clay. I am aware it has been said that the frequent fires burning the vegetation, and the rains washing the liberated salts into the hollows, cause these accumulations of saline matter. But I know that terrestrial plants produce potash when burned, but not the salts which are found in these soils.

The dry arid tract around the Hand Hills has more creeks with flowing water than are to be found in the much larger area of the Great Plain, where the soil is of a different character.

Here, near the Hand Hills, flowing water and Cactus, with dried-up grass and poor soil, gave another proof that the Cretaceous clay was a factor in more problems than one. It had been a question for a long time unanswered, why there were no creeks in the country further to the eastward where the rainfall was greater. Here, where the rainfall is light, were numerous creeks, and the answer came at once, the impervious clay would not allow the rain to enter the earth, and hence it made its way to the creek and so to the river. In no other section of the country did we ever find the water running in streams on the surface after a storm, except in this locality. I account for the absence of creeks to the fact that the winter frost exerts a surprising pulverizing effect on friable soil, which permits both roots and rain to penetrate to a great depth.

Scarcely any running water, and little of what could be called pure, is found on the Great Plain, but many ponds remain throughout the season, giving evidence that they are supplied from springs. Those that retain water all summer are easily known by their vegetation, River weed (*Potemogeton gramineus*), Bladder Wort (*Utricnlaria vulgaris*), and a few other species being found in most of them—while the level country retains no moisture on its surface, except as marshes, the slightly undulating may have abundance in the early summer, in wide depressions, yet by the middle of August this, to a great extent, disappears. It was on the slightly rolling country, with a more or less clay surface soil, where we found difficulty in finding water last season. On rolling prairies or rolling hills water was always abundant throughout the season, and the higher the knoll the more certain were we that water in a deep pool lay at its base.

The rainfall, as I have stated in another place, is quite sufficient for all purposes, and pure water has been obtained without any difficulty wherever a settlement has been formed on the Second Prairie Steppe. Although we woud travel sometimes 100 miles without seeing flowing water, and often 10 miles without seeing a drop of any kind, this was no proof of its scarcity. From Pine Creek to Boggy Creek there are 16 miles of prairie. Upon this prairie there was not a drop of surface water when we crossed in 1875. Now, settlers are on every part of it, and abundance of water has been found at an average depth of fourteen feet.

To the question why, in a country which I assert to have a sufficient rainfall, there are no running brooks? I answer that so long as the face of the land is covered with tall or close matted grass or thick sward, the water *cannot* run off, and no brooks or stream valleys *can* be formed. The rainfall taking place only in summer is almost immediately absorbed into the soil and disappears. It was a noticeable fact that Big Cut Arm Creek was very little affected by the almost continuous rains of June, and yet all the ponds and marshes were full on the prairie 200 feet above the bed of the creek. When we returned again, in the latter part of October, most of the ponds were without water, but the creek was nearly as high as in June. The water being absorbed by the soil, remains in it as it would in the finely pulverized earth of a flower pot, and is either taken up by the roots, which penetrate to a very great depth, or passes down into the sub-soil. No one who has not lived on the plains can properly appreciate the pulverizing effect of frost on the western prairies where the snow fall is so light and the penetrating power of frost so great.

Let the sward be taken off by fire or any other means, and instead of rain penetrating into the soil, it will run off into the hollows, and the land without grass will become drier. Clay soil that bakes without cracking, and land without sward will necessarily allow the rain water to run off, and small streams will be found in the hollows, and, eventually stream valleys will be the consequence. These we found at the Hand Hills under the above conditions. To receive the water, then, the surface must either be broken up or covered with a thick carpet of grass, which would act as a mulch; this it finds in the old grass. It is quite true that horses prefer the young grass to the old and young mixed together, but it is just as true that fires passing over the country where the rainfall is light prevent nearly all the grass from seeding that year, and it is only the second year after a fire that seed in any quantity can be obtained. When collecting grasses and carices last season, I always obtained my specimens on the unburnt ground. It is quite possible that the plain appears less arid now than when Palliser crossed it, as owing to the absence of the enormous herds of buffalo the grass now remains from year to year, if not burnt off. The term "short, crisp grass of the prairie," which has become a household phrase, will not be applicable as soon as the fires cease, and where the water runs off now it will pass into the soil through the old grass (or mulch). Three years without fires would change the growth of grass so much that many would think the rainfall had increased, when it was only retained by nature's own covering. On the prairie east of Long Lake, where the fire had not been, the grass was twice as long (July 4th) as where it had been burnt over, but the horses always went to the new grass, although quite short in comparison to the other. Here the frequent fires had gradually lessened the surface loam and exposed many of the little pebbles scattered through it, and had we not dug into the soil we would have done as others did before us, classified the soil as gravelly, whereas it contains very little of it.

Wherever the grass was long the ground was soft, but the reverse was the case where the grass was short, from whatever cause. Mulching, then, is what the country wants, and it can never get this until stringent steps are taken to prevent prairie fires.

Salt lakes, ponds and marshes are a characteristic feature of the country, but they attain their highest development on the Third Prairie Steppe. Many of these ponds, and even a few of the lakes are fresh in the spring, but after the middle of summer become brackish. Except the brackish water of the Touchwood Hills, of which I do not know enough to speak with certainty, all other was found in the deepest depressions. In no coulée was pure water obtained, except from a spring along its face. All other water in the coulées was more or less saline. Lines of salt ponds or lakes, sometimes of large dimensions lay in the deep valleys separating the ranges of hills on the high plains, and they were always to be found, whether the ground was high or low, where the Cretaceous clay came to the surface. Travellers too often descend into valleys for water, whereas my experience shows that they should go out of them into the hills. The conclusion formed regarding the salt lakes and marshes, is that they rest on the Cretaceous clay which evidently contains salt, as

I invariably found plants peculiar to a saline soil where this clay cropped out, and water oozed from it. In speaking of the brackish nature of the water oozing from these Cretaceous clays, I may just remark that in examining the soil small crystals of selenite, pyrites, and other sulphurous minerals are almost always to be found, showing that it is to the presence of these deleterious ingredients that the water obtains its brackish character and must of necessity always be so. There is not a river or creek valley throughout the whole interior that lies 150 feet below the level of the prairie, along which you will not get salt marsh plants if water in the form of springs oozes out of this clay, which, as far as my observations go, is always there, though its presence is only detected by the salt marsh plants. Various species of grass were abundant on the marshy spots of which Brizopyrum spicatum, and Spartina gracilis were the most prominent. The former is the only grass on the plains which is really deletereous, and no horse will touch it except he is forced by hunger. Often it may be seen in company with Arrow Grass, (*Triglochin maritimum*) growing in salt marshes and covered with a white crust left by the evaporating waters.

Salt lakes and marshes are of frequent occurrence where sand hills join the plain, and salt depressions, either with or without water, are always found in this connection. Within the line of sand, however, good water is sure to be obtained in all cases. A little experience only is necessary to detect brackish water by inspection of the vegetation. None of the salt lakes or ponds have a marshy or black muck border or contain any sedges except Scripus maritimus and pungens. On the other hand, all the fresh water ponds have rich black soil around their margins or are filled in every part with grass and various species of Carex, of which Carex aristata is the most prominent, and the one eaten constantly by the horses in summer. Between the Little Touchwood Hills and the more western range many ponds of water that are good in summer are bad in October, owing to evaporation. Good water may always be known, here, by the sedge in the ponds remaining green, close to and in the water, while, if the pool has become brackish, the sedges in the centre of it rot and apparently die.

Wells sunk to a moderate depth anywhere in the drift which covers the whole country, except in the baked clay flats and deep valleys between ranges of hills, will contain good water. All wells sunk *through* the drift into the Cretaceous clay will likely be more or less brackish. Hence, I advise all settlers to do as I advised McKernan, at Hay Lakes, when he obtained bad water by sinking a deep well, that he was to dig in the drift and never go through it and good water would always be obtained. McKernan's well was 14 feet deep, and the water unfit for use, while by digging a well about 50 yards to one side of the other, and only five or six feet in depth, he found good water (this well was dug 28th September at the close of the dry season.) All the country around Hay Lakes seemed to have but a thin coating of drift, yet the land was remarkably fertile and contained abundance of water on or near the surface. I consider the absence of water a good sign on the prairie. It shows that the soil is well suited for farming purposes, but it is no proof that water cannot be had by digging.

### SUPPLY OF WOOD FOR FUEL AND BUILDING PURPOSES.

In Pheasant and File Hills, and throughout the Touchwood Hills, as also a tract of country lying east of Humboldt, there is abundance of wood for the prairie settlers for many miles on all sides of the hills. This wood is only poplar of two species, and can be used in house building, both for walls and floors.

West of the Saskatchewan the Eagle Hills will furnish a supply for the northern part of the Great Plain. Battle River throughout its entire length will furnish wood for all purposes to the country on both sides of it. Spruce in some abundance can be obtained on its upper waters and floated down to any point. Red Deer River passes through a country more or less covered with forest, as far south as Latitude 52°, but after that to its confluence with Bow River the only wood in the country it passes through is found in its own valley or its bordering coulées. This is so small in quantity in comparison to the district to be supplied that it need merely be mentioned but not taken into account. No doubt large quantities of spruce exist on the upper waters of the river, and can be floated down to any point on the stream. There are no obstructions of any kind anywhere in the river, but on the lower part of its course it would be extremely difficult to get loaded waggons out of its valley.

Bow River, on the other hand, does not flow through forest on any part of its course east of the mountains, yet it contains many fine groves of poplar from a few miles below the Blackfoot Crossing to the Mountains, both in its valley and the coulées opening into it. Balsam poplar and Cottonwood (*Populus monilifera*) are found of a large size at the Blackfoot Crossing, and numerous groves of spruce are seen above Calgarry. The whole country on both sides of the river is absolutely without wood, except in the tributary valleys on the south of the main stream. Quantities of very good spruce and Douglas pine can be obtained on Dead Man's River on the north, on the Kananaskis on the south, and up the valley of the main stream for at least 60 miles above Morleyville. No difficulty will be experienced in floating down either logs or boards, as the river for 60 miles into the Rocky Mountains is free from dangerous rapids.

It will be seen by the foregoing remarks that wood is scarce in the southern part of the section explored, but this is in some degree compensated for by the immense deposits of lignite or coal known to exist. On Bow, Red Deer and Battle Rivers, these crop out in many places, and specimens burnt on the ground, and others brought home, testify to their value for fuel. As mentioned on another page, a trader and farmer named French has burned coal, taken from a six-feet seam at the Blackfoot Crossing, for two years. He finds it burns well in self-feeding coal stoves, of which he has two, and I found it to burn well and for a long time on an open fire.

### COAL AND STEAM NAVIGATION OF SOUTH SASKATCHEWAN.

In my journal I showed why I believed the South Saskatchewan was navigable, and I now reiterate the statement after a careful review of all said for and against it. When its navigation is an accomplished fact, all supplies for the police and Indians can be taken to within less than 50 miles of Fort Walsh at Cypress Hills and those for Fort McLeod, landed at the forks of Bow and Belly Rivers within two short days, journey of the Fort. Here (at the Fort) is abundance of coal, so that there will be an ample supply of fuel for all purposes. It is currently reported that all the settlers in the vicinity of the Fort burn this coal. Messrs. Patrick and Nelson, two surveyors whom I met at Morleyville, told me they had discovered coal in numerous places south of my line of exploration. In view of the difficulty of supplying the Indians, and the importance of opening up the country, I would suggest that an attempt be made at an early day to solve the problem by sending one of the steamers now plying on the Assiniboine on that service. That the ascent can be made without any more difficulty than that experienced in ascending the North Saskatchewan, I am quite sure, as I have had an opportunity of seeing both rivers. The importance of this subject, certainly recommends it to an early consideration. Red Deer, Bow and Belly Rivers, all issuing from the mountains, must send more water into the main channel late in the season than the North Branch, and, therefore, this river will be longer suited for navigation every season. If the coal deposits can be developed by this means all the prairie land seen by me will become in the course of years thickly settled with a prosperous population, as there is no physical defect in the country but the want of wood.

In every place where lignite was seen, more or less brown or clay iron ore was present, and it is extremely probable that a more thorough examination of the country will reveal large deposits of it in connection with the lignite.

### CONDENSED SUMMARY OF LANDS AVAILABLE FOR SETTLEMENT BETWEEN MANITOBA AND THE ROCKY MOUNTAINS.

In your Pacific Railway Report for 1877, page 336, I endeavored to classify the lands east of the Rocky Mountains on the best data then in my possession. Since

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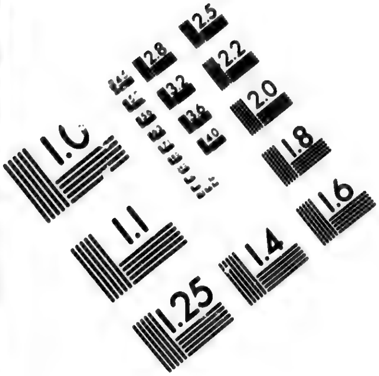
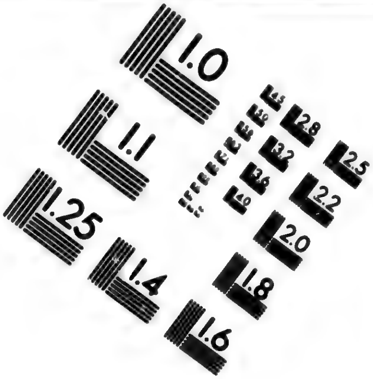

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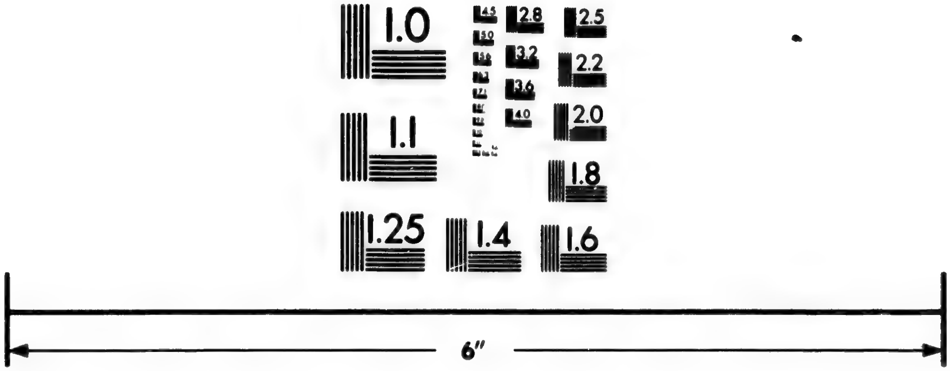

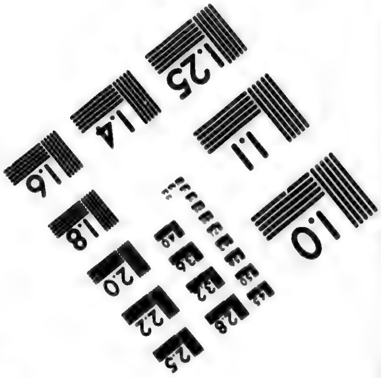

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then I have had opportunities of gaining a much more extended personal knowledge of the region, and I have had access to the reports of all the recent explorations made by others, and had personal conversations with the several explorers. I am, therefore, in possession of much additional data, and in a position to classify the areas of land with greater general accuracy. I now submit what I consider a tolerably correct estimate of the areas of the several descriptions of land, between the Rocky Mountains and Manitoba, not including the latter Province and excluding also any available land that may exist north of the 57th parallel in the Peace River District.

**Areas** of the several descriptions of Country between Manitoba and the Rocky Mountains, within the limits defined and indicated on the accompanying map.

| Number. | Description. | Square Miles. | Total of Square Miles good Land. | Total Square Acres of good Land. |
|---|---|---|---|---|
| 1 | Total area north of latitude 51°, east of Mountains and west of Manitoba, and as far north as good land is known to extend, exclusive of Peace River District.. | 160,442 | | |
| | Deduct for bad and wet lands.......... | 23,000 | 137,442 | 87,962,880 |
| 2 | Peace River District as far as explored. Dr. Dawson's estimate.......... | 31,550 | | |
| | Deduct for wet lands, and land known to be bad, and estimated quantity to be bad in unexplored parts..... | 6,000 | 25,550 | 16,352,000 |
| 3 | Total area north of Boundary and south of latitude 51°, and between Manitoba and the Rocky Mountains..... | 90,510 | | |
| | Deduct for sandy or arid land.......... | 19,000 | 71,510 | 45,766,400 |
| | Total areas of land fit for Agriculture and Pasture... | .......... | 234,502 | 150,081,280 |

In this estimate I have made a deduction of 48,000 square miles from the total area. It must not be understood that the whole of this deduction, which exceeds 30,000,000 acres, is of no value. The territory in question is like many other countries on the surface of the globe, being not uniformly fertile, but containing tracts of bad and unproductive land. Within the whole area of 180,000,000 acres there are isolated patches of unavailable land, consisting of marshes and swamps, sand-hills, barren clays and stony tracts. Possibly not over one-third or 10,000,000 acres of the whole 48,000 square miles, which I have deducted from the total area could be classed as sterile or irreclaimably wet. There can be no doubt that drainage will ultimately do much to contract the area of land now estimated as valueless.

At present I consider that in the north-west of Canada, beyond Manitoba and within the western and northern limits defined, there are at least 150,000,000 acres of land suitable for agriculture and stock raising, and of this area I feel confident that a higher percentage will be found available for growing grain than in that portion of the Province of Ontario so well known for its productions,—I refer to the peninsula lying between the lakes Huron, Erie and Ontario, and bounded on the north and east by a line drawn from Kingston to Lake Simcoe and the Georgian Bay.

I have the honor to be, Sir,
Your obedient servant,
JOHN MACOUN.

Sandford Fleming, Esq., C.M.G.

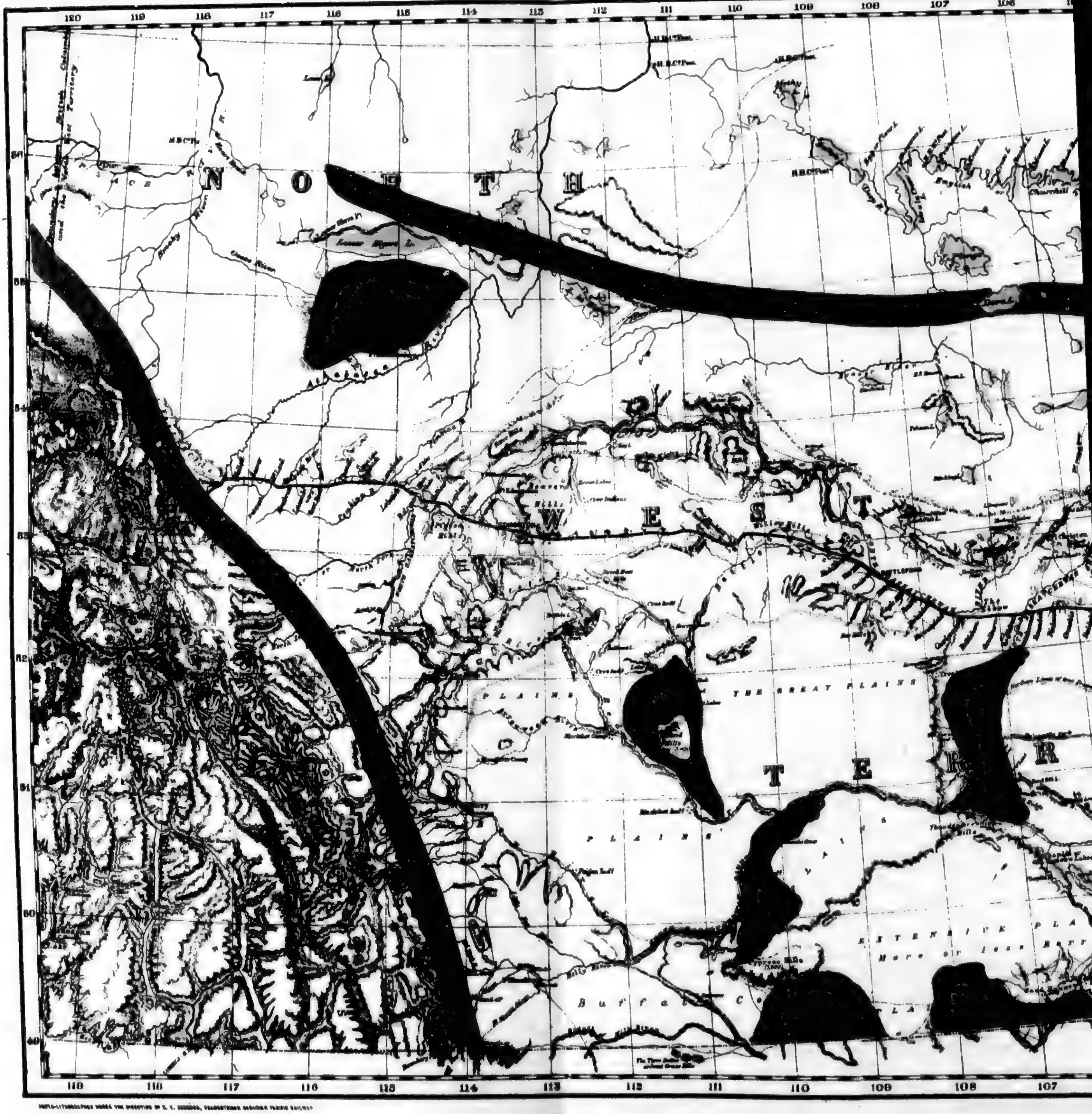
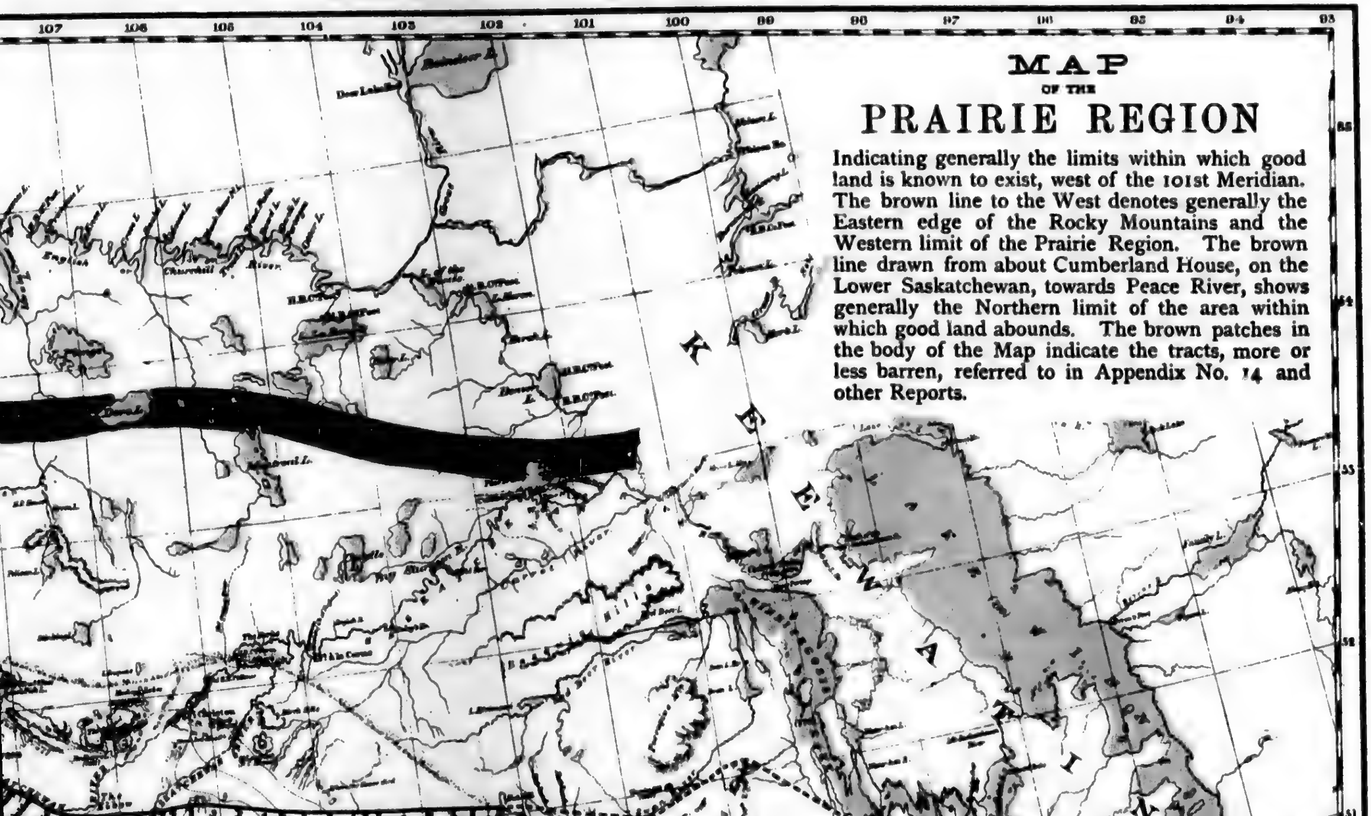


PHOTO-LITHOGRAPHED UNDER THE DIRECTION OF [illegible], ENGINEER-IN-CHIEF CANADIAN PACIFIC RAILWAY

**Plate No. 8.** *To accompany Report of the Engineer-in-Chief, Canadian Pacific Railway,* 1880.



# MAP
OF THE
# PRAIRIE REGION

Indicating generally the limits within which good land is known to exist, west of the 101st Meridian. The brown line to the West denotes generally the Eastern edge of the Rocky Mountains and the Western limit of the Prairie Region. The brown line drawn from about Cumberland House, on the Lower Saskatchewan, towards Peace River, shows generally the Northern limit of the area within which good land abounds. The brown patches in the body of the Map indicate the tracts, more or less barren, referred to in Appendix No. 14 and other Reports.

THE BURLAND LITHOGRAPHIC CO. MONTREAL

# APPENDIX No. 15.

## REPORTS IN REFERENCE TO THE LOCATION OF THE SECOND 100 MILES SECTION WEST OF RED RIVER.

CANADIAN PACIFIC RAILWAY,
OFFICE OF THE ENGINEER-IN-CHIEF,
OTTAWA, January 15th, 1880.

The Honorable
Sir CHARLES TUPPER, K.C.M.G.,
Minister of Railways and Canals.

SIR,—I have the honor to report on the surveys which have been made last summer, immediately to the west of the Province of Manitoba, with the view of locating the railway west of the Riding Mountains and commencing construction on the "second one hundred mile section."

The Government having determined to change the location of that portion of the line from Selkirk, *viâ* the Narrows of Lake Manitoba to Livingstone, and establish a line which would generally follow the course of settlement, due westerly through the Province of Manitoba, it became my duty to have an instrumental survey made through the district. The service was placed in the hands of Mr. Marcus Smith, to whom I furnished the instructions appended.

Acting on these instructions, two lines have been surveyed, both commencing near the western boundary of the Province of Manitoba. One extends westerly, the other north-westerly. Both surveys are, however, incomplete, the winter having closed in and stopped further operations. The continuous measurements on the western line are limited to 110 miles, terminating at a point about four miles beyond Fort Ellice; those on the north-western line, at Bird-tail Creek, at a crossing a little south of the 6th Base Line and 105 miles from the common place of beginning.

The country has been explored and some examinations have been made beyond Fort Ellice and Bird-tail Creek, but the two instrumental measurements terminate at the points above mentioned. The distance unsurveyed from these points to a common point of intersection on the located line (some 60 miles west of Livingstone) may be estimated at about 150 miles.

Surveys were made in 1877 which showed "the the bridging of the valleys of Bird-tail Creek, Shell River and the Assiniboine would be so enormously heavy as to render construction" on the line then defined inexpedient. During the past summer, another line (the western line) was projected to enter the valley of the Assiniboine below the mouth of Bird-tail Creek, thence up the Assiniboine to its junction with the Qu'Appelle.

A third line (the north-western line) was surveyed during last summer, commencing at a common starting point and following the western line about eight miles west of the western boundary of Manitoba: it then diverges to the north-west in a straight course to the Little Saskatchewan, where the northern trail crosses the river (Tanners' Crossing), and thence in a nearly north-westerly direction to Bird-tail Creek. From Bird-tail Creek the line is projected in a northerly course towards Duck Mountain with the view of getting a practicable crossing of Shell River. From Shell River the line is projected in a north-westerly direction, but the survey has not been executed beyond this point.

For detailed descriptions of these two lines—the western and the north-western—I beg to refer to the report of Mr. Smith, of date 30th December last. The surveys, as far as they have been extended, have been made with care and judgment, in proof of which, points have been found on the deep and exceptionally wide valleys which traverse the country, where the crossings, although still somewhat formidable, do not appear so objectionable as those previously reported.

On the Western Line the principal gradients are as follows:—

| — | CHARACTER OF GRADIENTS. | | |
|---|---|---|---|
| | Rate per mile. | Length. | Total rise or fall. |
| | Feet. | Miles. | Feet. |
| Ascending Westerly.—From the 1st to 7th mile... | 47½ to 53 | 5.3 | 259 |
| do 21st to 38th " ... | 32 to 53 | 10.4 | 496 |
| do 45th to 50th " ... | 35 to 53 | 4.3 | 191 |
| Descending Westerly.—From the 50th to 44½th mile | 47½ to 53 | 4 5 | 229 |
| do 91st to 96th " | 53— | 5.2 | 274 |

As the survey terminates at the bottom of the Assiniboine Valley, above Fort Ellice, the prairie level on the northern side must be regained, involving an ascent of about 300 feet.

The principal gradients on the north-western line are:—

| — | CHARACTER OF GRADIENTS. | | |
|---|---|---|---|
| | Feet per mile. | Length. | Total rise or fall. |
| | | Miles. | Feet. |
| Ascending Westerly.— From the 1st to 7th mile.. | 47½ to 53 | 5.3 | 259 |
| do 18th to 33rd " ... | 37 to 53 | 10.3 | 560 |
| do 38th to 44th " .. | 32 to 53 | 6.3 | 263 |
| do 98th to 103rd " . | 47½ to 53 | 4.2 | 216 |
| Descending Westerly.—From the 33rd to 38th mile | 32 to 34 | 3.8 | 133 |
| do 92nd to 98th " . | 42 to 45 | 5.9 | 277 |

On the remaining 150 miles, other deep valleys have to be crossed, the principal being Shell River and the Assiniboine.

The Western line passes over ground, to the east of the Little Saskatchewan, 1,794 feet above sea level. The North-Western line attains an altitude east of the same river of 1,800 feet, and on the slope of the Riding Mountain, to the east of Bird-tail Creek, of 2,050 feet. To give some relative idea of these elevations, I may mention that the section now under contract through Manitoba will average less than 850 feet above the same datum.

The work on both lines is heavy for a railway through a prairie country, due in some measure to the endeavor to keep the several long ascending and descending gradients under 53 feet per mile. This has the effect of raising the average earth excavation, according to Mr. Smith's estimate, to about 16,000 cubic yards per mile.

The surveys, to the extent they have been made, have been successful in establishing that workable lines can be had in the directions described. The engineering features presented by the surveys of the Western, as well as the North-Western line, as the tables of gradients indicate, are not so favorable as could be desired, but I am aware that the Government attaches great importance to carrying the railway through this section of desirable country for settlement; that the settlers themselves have strong claims on the Government for a means of communication, and that it is the speedy occupation of the land and the cultivation of the soil by prosperous settlers, that will lead to the successful working of the railway and the general advancement of the country.

Mr. Smith has projected another line "diverging from a point near the 8th mile (from the boundary of Manitoba), and taking a south-west course, which strikes the valley of the Assiniboine a little above Grand Rapids. This would be about 33 miles in length, across a plain of rich land. on which there are a number of settlements, and construction would be very easy."

I have carefully examined all the data at command, and I think that a modification of the latter line points to a scheme worthy the consideration of the Government. If the railway be carried to a point in the valley of the Assiniboine, near the mouth of the Little Saskatchewan, where the land remains unsurveyed and ungranted, there might here be established the site of a city which would shortly become important. This extension would be from 50 to 60 miles west of the boundary of Manitoba, and about 150 miles west of Red River. It would avoid the very elevated ground, east of the Little Saskatchewan, passed over by the other lines, and which involves ascending and descending gradients of great length; it would have no heavy adverse gradients from the west, and taken with the sections now under contract, it would form a trunk line, extremely favorable for cheap transportation, all the way from Lake Superior to a point commanding a fine agricultural country, and from which desirable colonization lines might, in the near future, diverge (1) to the north-west, (2) to the west and (3) to the south-west, and thus the projected city would become an important railway and business centre.

The line stretching from this projected point of junction to the north-west would pass up the valley of the Little Saskatchewan and across to Bird-tail Creek, probably intersecting the north-west line, as recently surveyed, near the crossing of that stream, and thence on its projected course to a point on the located line west of Livingstone. One of the other lines from the point of junction would tap the coal deposits which are known to exist north of the International Boundary, and the entire absence of heavy adverse gradients on the trunk line to the east would admit of coal being delivered in the Province of Manitoba at very low rates. The line diverging to the south-west would serve the country along the valley of the Souris, and, if extended beyond the International Boundary line, would run directly to the Yellowstone Valley, and would render it practicable in the future to tap that region and draw its traffic into Canadian channels.

The extension from the end of Contract No. 48 (John Ryan's contract), to the point referred to near the mouth of the Little Saskatchewan, might at once be put under contract in the same manner that Contract No. 48 itself was let. As soon as possible thereafter, the line up the Little Saskatchewan and to the north-west may be placed under contract. I would advise that the latter line be located as a cheap surface line, that deep excavations, high embankments and heavy work, with the view of securing low gradients, be avoided. That the great aim be to have the rails laid through the district with any reasonable gradients and curves that can be worked by light trains, of course, taking care that the best alignment and gradients which the peculiar features of the country will admit of be secured, without unnecessarily increasing the expense. I would aim at having as useful a line as can be had, and as cheap as it is possible to make it.

The length of this line would be somewhat increased by taking the course suggested. It is considered that this disadvantage would be more than compensated by the greater breadth of fine country rendered available for successful settlement. The line, besides answering colonization purposes, would connect probably at Nuthill, with the line located to Yellowhead Pass, and would afford facilities for construction and settlement in the direction of Edmonton, and as far as the prairie region extends.

I respectfully submit this suggestion for consideration. Besides aiming at securing, without delay, a through communication sufficient for all present purposes, and affording facilities to settlers to occupy desirable land, the project has in view other objects, the importance of which I feel assured the Government will recognize.

The adoption of the line to the point I have indicated in the valley of the Assiniboine, near the mouth of the Little Saskatchewan, would provide 150 miles of an excellent trunk line leading from Winnipeg and Selkirk to the coal deposits, and would to that extent make provision for the supply of fuel, where no timber now exists, and and thus anticipate a want already sorely felt in many quarters. The laying out of a city at the point mentioned, and the location of stations at regular intervals on other ungranted lands along the line, would secure to the Government, all the benefit arising from the enhanced price which would be given to the land, to assist in meeting the cost of the railway.

I herewith submit two plans, one showing in blue the ungranted blocks of land, one mile square, suitable for stations, through the Province of Manitoba, and as far as the proposed town site at the mouth of the Little Saskatchewan. The other plan shows the several lines referred to; the approximate lengths as compared with the old located line, by the Narrows of Lake Manitoba between common points, Selkirk and Nut Hill—the latter about 60 miles west of Livingstone—may thus be stated:

SELKIRK TO NUT HILL.

| | | |
|---|---|---|
| By No. | 1. The North-Western Line .......................... | 350 miles. |
| " | 2. The Western Line.................................... | 365 " |
| " | 3. The Southern Line........................... | 370 " |
| " | 4. The Narrows of Lake Manitoba.............. | 330 " |

I have the honor to be, Sir,
Your obedient servant,
SANDFORD FLEMING,
*Engineer-in-Chief.*

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## CANADIAN PACIFIC RAILWAY.

OFFICE OF THE ENGINEER-IN-CHIEF,
OTTAWA, 14th June, 1879.

MEMORANDUM OF INSTRUCTIONS FOR MR. MARCUS SMITH.

The Hon. the Minister has authorized the undersigned to instruct Mr. Smith to proceed to the prairie region and conduct certain explorations and surveys.

These explorations and surveys are confined to the district between the Red River and the south branch of the River Saskatchewan.

The object of the examination is to find the most eligible line for the railway, having in view its passing conveniently near the greatest extent of land suitable for settlement, between Selkirk and the crossing of the Saskatchewan, about latitude 52° 20'.

Mr. Wm. Murdoch has been furnished with instructions bearing date 23rd May last, a copy of which is attached. These instructions cover the survey operations between Red River and the western boundary of Manitoba. It was intended to direct Mr. Murdoch, on the completion of all the work necessary within the Province of Manitoba, to extend the surveys westerly towards the Saskatchewan.

It is, however, advisable to lose no time in gaining the information desired. Accordingly, Mr. Smith is instructed to proceed at once to the district referred to. He will personally explore the country west of the Province of Manitoba, to determine where an instrumental survey should be made. He will be supplied with assistants in order that the exploration may be followed up by an instrumental survey.

Mr. Smith has already made some explorations in this district; he will the more easily determine the best points for crossing the several rivers. Possibly, he could at once start the survey party, say at the Little Saskatchewan, east of Fort Ellice, thence to work westerly in a direction which the exploration to be made will establish.

In the event of this instrumental survey being commenced at the Little Sakatchewan, Mr. Smith will send information to Mr. Murdoch of the fact, with instructions to extend his surveys to that point, and there form a connection with the levels and measurements.

The crossing of the south branch of the main Saskatchewan by the located line may be taken as the extreme westerly objective point. Mr. Smith will use his best efforts to find the best line that can be had, following the general direction of the Touchwood Hills, and passing the elevated ground to be met, either to the north or south.

Although the crossing of the South Saskatchewan may be taken as the westerly objective point, Mr. Smith, while in that quarter, will sufficiently examine the country to ascertain if any advantage would be gained by making the connection with the present located line near the elbow of the North Saskatchewan.

The undersigned is aware that there are several very wide and deep valleys in the country to be traversed west of the Riding Mountains, but he feels assured that Mr Smith will be able to find satisfactory crossings, if such exist; and, at all events, he will be able to furnish a plan and profile, from actual survey of the best line which can be had, between the crossing of the south branch and of the main Saskatchewan and the proposed point on the Little Saskatchewan referred to.

Lest no line, in every respect satisfactory, be found south and west of the Riding Mountains, it is important to have a survey made to the east. Mr. Smith will accordingly instruct Mr. Murdoch, after completing the service upon which he is now engaged, and closing his work on the Little Saskatchewan, to survey a line around the south-westerly end of Lake Manitoba, passing Dauphin Lake to the east, or to the west, as may seem best, and connecting with the located line at the most convenient point between the narrows of Lake Manitoba and Northcote.

These several surveys completed, and plans and profiles prepared, we shall have definite information, which will admit of a comparison of three main routes between Selkirk and a common point on or near the south branch of the main Saskatchewan.

Mr. Smith will find in Mr. Murdoch's instructions and the accompanying letters ull particulars with regard to the system of procuring supplies, making payments and keeping accounts. He will observe that the Purveyor's Branch is abolished, and that the engineer conducting the survey is himself now held reponsible for the expenditure. Mr. Smith will be required to accommodate himself to the change.

The Hon. the Minister has selected the following assistants to accompany Mr. Smith.

W. D. Barclay,
E. McNicol,
L. Desbrisay,
M. Harris.

Mr. Smith will forward progress reports as frequently as possible.

SANDFORD FLEMING,
*Engineer-in-Chief.*

## REPORT OF SURVEYS AND EXPLORATIONS BETWEEN RED RIVER AND THE SOUTH SASKATCHEWAN, BY MR. MARCUS SMITH.

CANADAIAN PACIFIC RAILWAY,
OTTAWA, February 25th, 1880.

SANDFORD FLEMING, Esq.,
Engineer-in-Chief.

SIR,—In a memorandum dated June 14th, 1879, addressed to me, you stated that the Honorable the Minister had authorized you to instruct me to proceed to the prairie region and conduct certain explorations and surveys.

These explorations and surveys were confined to the district between the Red River and the south branch of the River Saskatchewan.

The object of the examination was to find the most eligible line for the railway, having in view its passing conveniently near the greatest extent of land suitable for settlement between Selkirk and the crossing of the Saskatchewan.

Mr. Wm. Murdoch had already reached Winnipeg in charge of a party to make the location survey of the line between Red River and the western boundary of the Province of Manitoba, a distance of about 100 miles.

Another party was formed in Ottawa to continue the surveys westward from that point, and they left on the 19th June in charge of Mr. W. D. Barclay. I reached Winnipeg on the 26th, and spent several days with Mr. Murdoch examining the country in the neighborhood and making arrangements for the employment of his staff during the season.

Meantime Mr. Barclay was engaged purchasing supplies, horses, carts, &c., and hiring the necessary teamsters and axemen, which he completed on the 8th July. For several weeks preceding this date the rainfall had been excessive, and the roads in many places on the low lands of the Province of Manitoba were almost impassable.

Taking advantage of the high water in the Assiniboine, steamboats were navigating that River, for the first time, as high up as Fort Ellice, to which the distance by road from Winnipeg is about 210 miles, but by the Assiniboine it is estimated to be fully 700 miles.

After due consideration I came to the conclusion that as it would effect a considerable saving in time, it would be true economy to send the party with all their plant, supplies and baggage on to Fort Ellice by steamboat. This would also give us an opportunity of seeing the country in the vicinity of the Assiniboine.

In the summer of 1877 an examination had been made of the valleys of the Little Saskatchewan, Bird-tail Creek, Shell River and the Assiniboine, within certain limits, the result of which is described in full in the Annual Report of the Minister of Public Works for that year, where it will be seen that a feasible crossing of the valley of the Little Saskatchewan was found, but those of Bird-tail Creek and the Assiniboine (at the mouth of Shell River) would involve works of such magnitude in bridging, that from all the information obtained up to that time, it did not appear advisable that any alteration should be made in the line as located in that district.

It was now proposed to examine the country for a line further to the south, so as to strike the valley of the Assiniboine below the mouth of Bird-tail Creek, and then cross that stream near its confluence with the Assiniboine, in the valley where the banks are low, and avoid Shell River altogether.

We left Winnipeg, July 8th, on the steamer "Marquette," Captain Weber, and travelled day and night till we reached the Grand Rapids, 15 to 20 miles above the mouth of the River Souris, which we could only pass in daylight. On nearing the mouth of Bird-tail Creek, Captain Weber kindly tied up the boat over night so as to give us an opportunity of examining the slopes of the valley between that and Fort Ellice in daylight, which we did from the upper deck of the steamer, and projected the course for the line at the only feasible point for descending from the level of the plateau to the bottom of the valley, with favourable gradients.

The Assiniboine from Winnipeg to Portage la Prairie resembles the Red River, varying from 15 to 30 feet below the level of the prairie, the slopes to the river being generally clothed with oak, elm, poplar, etc.

From Portage la Prairie westward the gradient of the river varies very little, but the country rises, and thus a valley of very considerable depth is formed, varying from two to three miles in width; the river meandering from bank to bank increases its length in places to three or four times that of the valley.

Near the western boundary line of the Province of Manitoba, the river crosses the slope or steppe by which the country rises from the low level of Manitoba to the next plateau, which is several hundred feet higher.

The banks of the valley are very high in this neighbourhood, rising from 200 to over 300 feet above the level of the river. The soil is sandy, and where the river strikes the foot of the slopes, heavy land-slips have occurred. The valley is two to three miles wide, swampy, with clumps of willows and is generally unfit for cultivation. The slopes are covered with oak, elm, poplar and some spruce.

From the mouth of the Souris River upwards the Assiniboine has risen nearly to the level of the plateau; its banks are low, and fine stretches of prairie are seen on each side. At the Grand Rapids, about 12 miles in a direct line above the mouth of the Souris, the banks are about 6 to 10 feet high and the valley has almost disappeared, only a gentle rise from the river to the prairie level is visible to the eye. Above the rapids the great trail to the hunting grounds of the south-west crosses the Assiniboine. The soil of the prairie here appears good, but probably it is rather light, as the banks of the river contain a considerable quantity of gravel.

We reached Fort Ellice on the 15th July, and commenced the survey the next day at the junction of the Qu'Appelle and Assiniboine Valleys, about four miles above Fort Ellice. I remained with the party till the 19th, at which time they had completed about 15 miles of survey, down the valley of the Assiniboine and obtained sufficient information to project a feasible line eastward to the boundary line of Manitoba, where they expected to meet Mr. Murdoch's party and join the surveys about half a mile north of the fourth base line.

The soil east of the Assiniboine on the main trail from Bird-tail Creek to Fort Ellice and extending southward to the Assiniboine, is good, but largely mixed with drift boulders which will cause a great deal of labour and some years to remove or thin sufficiently to allow the land to be worked freely.

Before proceeding with the description of the country west and north of Fort Ellice, I must invite your attention to the excellent map of part of the North-West Territories prepared by the Surveyor-General, and published by the Right Honorable the Minister of the Interior, a copy of which I send you herewith, which will enable you to follow the description.

I now formed a small party for a general examination of the country westward, and we commenced at the Assiniboine, following the west side of the valley up to the Red Deer Horn Creek, with the view of carrying the line up that valley to the level of the plateau, but found it impracticable. I then examined the valley of the Qu'Appelle up to the Big Cut Arm River, and the latter up to the crossing of the main cart trail to Carleton and Battleford. The only feasible line I found would commence near the confluence of the Rivers Qu'Appelle and Assiniboine and ascend gradually the northern slope of the Qu'Appelle valley for six miles, with a gradient of 50 feet per mile, where the line would reach the level of the prairie at a point 300 feet above that of the valley.

There would be some rather heavy excavation on this length, but the material of the slopes is fine sand, which could be moved cheaply.

The soil west of Assiniboine and north of the Qu'Appelle is very poor and sandy; west of the Big Cut Arm River it improves a little, but is still light, and the ground is indented with numerous small ponds. This is the general character of the country between the Qu'Appelle and the main cart trail to Carleton, until reaching the Pheasant and File Hills, the rise of which is scarcely perceptible to the eye, but they are partly covered with groves of aspen, and the soil is deeper than on the open prairie. This is generally the case wherever these woods occur.

There is a broad belt of fine country, dotted with groves and clumps of poplar, giving the country a park like appearance, stretching from the Qu'Appelle Lakes northward by the eastern slope of the Touchwood Hills and the Fishing Lake to the head waters of the Red Deer River. The soil is generally a light loam.

The valley of the Qu'Appelle at the lower end is sandy, but before reaching the Big Cut Arm the soil improves, and we saw fine crops of grass which would make good hay. The valley is a mile to a mile and a-half wide, and the river about 80 feet.

Near the Roman Catholic Mission, on the Qu'Appelle Lakes, there is a considerable number of half-breeds and Indians, squatted up and down the valley. In the spring they cultivate small patches of land, which, in the autumn supplies them with vegetables and corn for the winter, and in the summer they hunt buffalo on the great plains.

A good example is set them by Fathers Germain and Hugomond, who themselves cultivate a very large garden, raising all kinds of vegetables and some fruits, such as red currants, etc. They also raise considerable quantities of grain, and had barley cut and stored on 27th July, when I visited them. They complained of a scarcity of hay grass, and were mowing coarse swamp grass five to six miles from the Mission. The good Fathers loaded my buck-board with vegetables, which we subsequently found very acceptable.

On the 28th July we resumed our survey, taking a north-west course from Fort Qu'Appelle, as shown on the map, passing nearly midway between the Touchwood Hills and the River Qu'Appelle and its tributary, Long Lake.

We crossed some tracts of good land, but generally the soil is not deep, resting on a stratum of gravel and sand, and it soon became difficult to find water for the horses and for culinary purposes.

About 40 miles from Fort Qu'Appelle we crossed a lumpy country indented with numerous small ponds, around which are clumps of poplar; shortly afterwards we saw the Egg Hills, ten to twelve miles to the south-west. The country became less broken, but still rolling, and at 50 miles we entered on a bare prairie, not a bush to be seen as far as the eye could reach. We were nearly abreast of the west end of the Touchwood Hills, and entering on that dreary alkaline plain which is almost a desert, the soil only yielding a scant pasturage. This dreary plain extends from the Touchwood Hills westward nearly to the South Saskatchewan, southward to Long Lake and the range of hills which stretch from the head of it to the South Saskatchewan, northward beyond the telegraph line, and eastward around the Quill Lakes.

The range of hills between the head of Long Lake and the Saskatchewan is broken up into detached groups, rising abruptly 200 to 500 feet above the level of the plain; they are entirely bare, not the smallest bush to be seen, but there are numerous ponds and lakelets, some of them containing good water, others are very salt or alkaline. Along the northern edge of this range there is a narrow strip of fine land, well watered, and we saw several herds of deer upon it.

We struck the South Saskatchewan near the north end of the Moose Woods. We had been some days without wood for cooking, and very short of water; that which we did obtain from nearly dried up ponds and were forced to use was abominable, and some of the party, as well as the horses, suffered from it. Even the Wolverine Creek, which rises away to the north of the telegraph line, where the water is sweet, becomes before it reaches Long Lake to some extent impregnated with alkali, though it is still fresh enough to be fit for use.

We did not cross the river at this point, but subsequently learned that the country to the west of the river is of the same character, the soil being light and poor up to the Eagle Hills, along the foot of which there is a narrow strip of good land, which in the course of time has been washed down by the rains from the slopes of these hills.

We followed the right bank of the river northward to the Carleton cart trail. The soil is poor, and for some three or four miles back from the river it is thickly strewed with boulders, forming mounds and long, low ridges closely packed. The river here is from 40 to 80 feet below the level of the country; there is not much valley, but occasional low flats encircled by bends of the river, with high bluffs on the opposite sides, alternately.

Between the ferry and Fort Carleton several families have settled since I passed across in 1877, and quite a village at Duck Lake clustered around the trading establishment of Messrs. Stobart, Eden & Co. This firm has under cultivation a considerable quantity of land, and we saw a fine field of wheat beginning to ripen when we passed it on the 8th of August.

We reached Fort Carleton the same day and remained there until the 11th to rest the horses and replenish our stores, during which time I enjoyed the hospitality of L. Clarke, Esq., Chief Factor of the Hudson's Bay Company at this station.

Mr. Clarke has been long stationed at various posts in the northern region, and from him I obtained much valuable information respecting the country.

At Fort Carleton the peninsula or tongue of land lying between the two branches of the Saskatchewan is about 18 miles wide, and varies but little from this for 40 miles down to the heart of the Prince Albert settlement, opposite Sturgeon River, which falls into the North Saskatchewan.

Near Fort Carleton the soil is rather light; thence, on the trail to Prince Albert for the first 18 miles we passed over a pleasant, slightly rolling country of prairie interspersed with groves of poplar; soil variable, but generally of a light loam. We then crossed a sand belt four miles wide, covered with jack-pine and a few Prince's pine. It is said the grasshoppers have never crossed this belt.

Immediately beyond this the soil improves, and scattered homesteads appear. At about 30 miles the trail crosses Red Deer Creek; the soil beyond this increases in richness, and the homesteads are more numerous. The main settlement is on a low flat opposite Sturgeon River, where there are two churches—Episcopalian and Presbyterian, and the Bishop of Saskatchewan has his residence there. The Hudson's Bay Company have a trading post, and there are other stores, blacksmiths' and carpenters' shops, &c. But the life of the settlement is the saw and grist-mill owned and managed by Captain Moore.

Farm homesteads at intervals extend down the banks of the north branch of the river to the forks, and there is a settlement on the south branch principally of half-breeds. These settlements are rapidly increasing; on our way out we passed more than 100 people in one band going to settle there.

The soil is a rich light loam which produces crops of wheat averaging 30 bushels to the acre. There are occasional low level flats on the margin of the river; farther inward the land rises fully 200 feet above the level of the river. It is rather lumpy and rough, broken with numerous ponds and lakelets fringed with aspen and willows.

These high lands cost more labor to get them under cultivation, but I was informed they produce better crops than the low flats. On the uncultivated lands the natural crops of grass, wild peas and vetches were so heavy that when we left the trail we found great difficulty in forcing our way through.

About 18 miles above the forks the peninsula is crossed by another sand belt about four miles wide, covered with jack-pine. On the point of the peninsula there are two homesteads on which there were good crops of wheat nearly ripe, and good kitchen gardens. Mr. Beads who has resided there for some years, informed me that the ice on the south branch generally leaves about the 15th April, and on the north branch a week later. He described the country north from the forks of the river as level and fertile, being mixed prairie and woods for some 12 to 15 miles back to the great forest of spruce, pine and tamarac which bears away to the north-west.

From the forks down to Fort à la Corne, we found the soil rather sandy in some places near the river, but farther back it is fully equal, if not superior, to that at Prince Albert. On the Paonan Creek there are several farm homesteads taken up.

Mr. Goodfellow, the Hudson's Bay Company's agent at Fort à la Corne, stated that the land is good, and partly wooded on both sides of the river down to Nepowewin Point, about 35 miles, where the solid forest begins.

August 16th. We travelled southward from Fort à la Corne to Root River, and up the banks of the latter to its outlet from Waterhen Lake.

Here we found several fields of wheat with very heavy crops nearly ripe, and two farm homesteads. I examined the well at one of them and found a depth of 6 feet of black mould on the top, with 16 feet of stiff clay loam to the bottom of the well. Mr. Robinson, the proprietor, informed me that this summer there were fourteen farms selected, and a number of settlers were coming in next spring.

Looking southward from this point the dark outline of the poplar woods that crown the ridge of the Basquia Range was seen some 18 miles distant, but the rise of the slope was scarcely perceptible to the eye. There is an Indian cart trail from the lake running east to Stony Creek, about 25 to 30 miles where the great forest of spruce and tamarac commences and extends far away to the north-east. The spruce trees are said to run from two to three feet diameter, and make very fine lumber.

We started from the lake on a course south 30° east, bearing for Little Quill Lake, and reached the summit of the range without difficulty, about 19 miles from the lake, in which the rise is less than 200 feet. The surface of the ground is very uniform, the soil of the richest quality and several feet in depth, it is equal to the best parts of Manitoba, chiefly prairie, with scattered clumps of poplar and willow till near the summit of the ridge, which is nearly all covered with a forest of poplars.

On the southern slope we met with so much fallen timber where the woods had been burnt that we had to turn back, not having sufficient force to cut a way through for the carts.

We went due west along the northern slope of the Basquia range till we struck a great marsh in the form of an L, the length of the arms being about ten miles each and three to four miles broad. Waterhen Lake is on the north arm and the outlet, Root River, about 30 feet wide, is at the angle. We followed up the stream which flows into the north arm; it rises to the south of the range and flows through a depression south of Minitchinass Hill. The ascent through the pass is very easy, but the sides are rather rough, covered with brush and indented with lakelets.

On reaching the main trail from Carleton we followed it south-eastward to Humboldt telegraph station, thence we travelled by the telegraph line about 20 miles to the point where it is crossed by the trail to Fort Pelly. We followed the latter to the Quill and Fishing Lakes, making occasional diversions right and left, thence we took a south-east course, parallel to the White Sand River and five to eight miles north of it till we struck the trail from Qu'Appelle to Fort Pelly near the bend of the River.

The country between Minitchinass and Humboldt station is lumpy and broken with ponds and lakelets of alkaline water. The soil is generally poor and continues so westward to the bend of the North Saskatchewan.

Between Humboldt and the Quill Lakes the country is variable, in some places low and swampy, where there is much willow brush. But eastward of the point where the trail crosses the telegraph line there are several miles of beautiful park-like country, the trail winding in open glades between groves of aspen. Before reaching the Big Quill Lake we came upon an open alkaline plain, extending northward to the telegraph line; this continues eastward nearly to Fishing Lake, and probably, also, to some considerable distance north of the Quill Lakes.

Taking the telegraph line from Humboldt to a point 20 miles east of Livingstone as a base, and extending a line due north from the former point to the forks of the Saskatchewan, about 75 miles, and from the latter point also due north a hundred miles, it would include an area of 14,000 square miles, or nearly 9,000,000 acres, a very large proportion of which is land of the best quality of mixed prairie and bush, and fit for immediate settlement. The balance is chiefly forest of spruce and tamarac, but containing some fine tracts of land for cultivation when cleared.

South of the telegraph line, the meridian passing between the Quill Lakes and across the Touchwood Hills to the Qu'Appelle, would indicate very nearly the western limits of the good lands in this region; and another meridian extending southwards from a point near Fort Pelly to the Qu'Appelle, would mark the eastern limit, touching the belt of sandy soil on the borders of the Assiniboine. This would embrace an area of 10,000 square miles, or 6,400,000 acres, a very large proportion of which is good soil and eligible for settlement. The northern portion of it is park-like rolling land, well watered and partially wooded with poplar; the soil is sandy loam. The southern part is chiefly prairie and the soil is a light loam; on nearing the Qu'Appelle it is poor and sandy. The Quill Lakes are strongly alkaline, but the streams running into them from the north are fresh water. Fishing Lake and the numerous streams between it and the Assiniboine are also fresh.

We followed the trail from the bend of the White Sand River to Fort Pelly, and thence southward by the trail to Fort Ellice, running parallel to the Assiniboine and from three to six miles west of it.

The valleys of the White Sand and Assiniboine Rivers merge into one and form an extensive low level plain on which there is an Indian Reserve. At the confluence of the two rivers the former is about 80 feet and the latter 100 feet wide and the banks about 20 feet high. For 60 miles along the trail from Fort Pelly the soil is light, some portions of it swampy and dotted with ponds fringed with willows. On the last 50 miles to Fort Ellice it is pure gravel covered with a thin sod, making excellent roads but poor pasture.

From Fort Ellice eastward to the boundary of Manitoba the distance is about 100 miles. South of the Assiniboine up to the International Boundary we did not examine but were informed that there are some good agricultural lands on the Souris and at other points.

North of the Assiniboine the country rises gradually and imperceptibly to the eye up to the crown of Riding Mountain, 2,000 feet above the level of the sea. The southern portion of this district is chiefly prairie, the soil good but light in some places, and in others largely mixed with boulders. The depth of the soil increases northward and its quality changes to a heavy loam well suited for permanent wheat growing; groves and belts of poplar become frequent and ultimately merge into a solid forest, in which there are good spruce and tamarac.

The north-eastern slopes of Riding and Duck Mountains are precipitous, and the flat between them and Lakes Manitoba and Winnipegosis is generally marshy, intersected with sand and gravel ridges covered with spruce, tamarac and some maple.

From Fort Ellice up the east side of the Assiniboine to Shell River, is a belt of gravel ridges, evidently a former beach or river bed, some 10 miles wide, covered with a thin sod. Between that and Bird-tail Creek the southern part is a fine prairie and the northern a dense poplar bush. North of Shell River and extending from the Assiniboine to the base of Duck Mountain is a beautiful inclined plain, partially wooded, and the soil is very rich, especially near Big Boggy Creek where we saw very heavy crops of wild peas and vetches.

The Duck and Riding Mountains are separated by a deep valley over a mile in width, with fine soil in the bottom. The slope of the latter is heavily wooded but that of Duck Mountain is open pasture and more precipitous on the south-west side. On the north side there are belts of spruce and tamarac.

In this general description it will be understood that in detail there will be found tracts of good land in those districts where the soil is generally represented as poor and *vice versa*. There is great variation in the character of the country and the soils. In the southern side of the belt above described the country is chiefly prairie and the soil light or shallow, with a subsoil of sand and gravel, so that the crops ripen early, but there is a deficiency of good water and hay lands, and the grass is in general short. Northward the country is well supplied with fresh water, and there are groves and belts of poplar suitable for fuel and fencing. On the northern side of the belt these merge into dense forests and are mixed with spruce, tamarac, and some pine suitable for lumber for building and other purposes. Most of the country on the northern half of the belt has been covered with woods, so that the surface is rougher and will require more labour in cultivating. But the soil is deeper and stronger and yields very heavy crops of wheat and other cereals, which are two or three weeks later in ripening than on the southern half near the Qu'Appelle. The natural crops of grass, wild peas and vetches, northward, are very heavy. This great variety will facilitate settlement, as it affords a choice of soils and other conditions to suit people of various partialities.

From Fort Ellice we travelled eastward to the elbow of the Little Saskatchewan, where we arrived on the 8th September, and learned that the surveying party were at Tanner's Crossing of the Little Saskatchewan. They had completed the first line from Fort Ellice to the boundary of Manitoba, 110 miles, and were running a second line from that point north-westward that I had projected before leaving the party at Fort Ellice ten weeks previously.

During this time we had travelled fully 1,000 miles, in great part without a trail, and made a general examination of the country north and south of the main cart trail to Fort Carleton and Battleford, which crosses the Touchwood Hills. This, together with the examination made by Mr. Lucas and myself in 1877, has enabled me to lay down a line on the map herewith (green dashes - - - - ) shewing very nearly the centre of the great fertile agricultural belt which stretches from Manitoba to the Rocky Mountains, and north-westward along the base of the latter beyond the Peace River, with a branch southward from Edmonton.

It appears to me that the line of the Pacific Railway should be located as near to this as practicable and expedient, with this view I gave Mr. Barclay the courses for continuing the survey of the trial line he had commenced. We then went westward again to find out the best points for crossing the Bird-tail Creek, Shell River and Big Boggy Creek, which we accomplished in a fortnight. I gave Mr. Barclay final instructions for completing the season's work and returned to Winnipeg, which I reached on the 4th of October.

Mr. Barclay's party completed the trial line from the western boundary of Manitoba, a distance of 100 miles, to a point on the west side of the valley of Bird-tail Creek, and made a detached survey of the crossing of Shell River. I expected to have the assistance of Mr. Murdoch's party for the latter part of the season, so as to carry the survey beyond the crossing of the Assiniboine and clear of all difficulties, but was disappointed, as the party was otherwise engaged. We have however sufficient information to be assured that there are no great difficulties in crossing the streams westward, though there may be some intermediate points that will require careful surveys to keep down the gradients.

The following was submitted to you on the 30th December, before the Government had adopted either of the lines for construction.

## DESCRIPTION OF THE LINES SURVEYED.

The first line commences at a point on the western boundary line of the Province of Manitoba, a little north of the fourth base line, where the section under contract from Red River across that Province ends, and extends to the junction of the valleys of the Assiniboine and Qu'Appelle, as shown by the firm blue line A, B, C, D on the map herewith.

The altitude at the point A, according to Mr. Murdoch's survey, is 992 feet above the level of the sea. In the first mile it begins to rise from this level up the slope or escarpment to a higher terrace, which is reached at the end of the seventh mile, with gradients varying from 32 feet to 52·80 feet per mile.

This escarpment to the higher table land extends from the Riding Mountain south-westward to the International Boundary Line. It is furrowed and broken by the drainage of the country into a series of sand hills, which are partially covered with scrub oak, poplar and brush, and it is intersected at intervals by the White Mud, Assiniboine and other streams. The excavation on this length will be rather heavy, averaging on the trial line 33,000 cubic yards per mile.

The altitude at the seventh mile is 1,268 feet; thence to the 21st mile the country is nearly level, the altitude at that point being 1,252 feet. The surface, however, is indented with a number of small ponds and hollows. It is generally prairie and the soil is good.

From the 21st mile it rises gradually to the 40th mile, where the altitude is 1,761 feet. The surface is rather lumpy, and the last four miles is partially covered with clumps and belts of poplar and scrub. The soil is generally good.

From the last point the line begins to cross the valley of the Little Saskatchewan obliquely, descending to the river with a gradient of 52·80 feet per mile for four and one-half miles, the altitude at the river being 1,531 feet The ascent to the table land on the west side of the valley is made in four and three-quarter miles, with gradients varying from 36 to 52·80 feet per mile.

The earth-work in crossing the valley would be moderate, averaging a little over 16,000 cubic yards per mile for nine milles, and the river could be bridged with one span of 120 feet, with the road-bed 15 feet above the surface of the water.

Recently a town plot (Rapid City) has been laid out in the valley, about one mile north of the line, where a saw-mill and other buildings and dwellings have been erected. There are also several farm homesteads occupied on each side of the valley.

The altitude at the 49th mile is 1,696 feet. Thence the line takes a straight course up to the 91st mile on the left or north bank of the Assiniboine, where the altitude is 1,509 feet. The inclination is very gradual, but the surface is rather lumpy, slightly undulating and intersected with several narrow coulées. It is chiefly prairie, dotted with clumps of poplar and brush. The soil is good till approaching the Assiniboine, when it is intermixed with a large proportion of boulders, and gravel underlying.

From the 91st to the 96th mile the line descends obliquely the slope of the Assiniboine, with a uniform gradient of 52·80 feet per mile, to the bottom of the bottom of the valley, near the mouth of Bird-tail Creek, where the altitude is 1,236 feet. The earth-works on this length would be heavy, averaging 39,000 cubic yards per mile for five miles.

Bird-tail Creek, at this point, can be bridged with one span of 100 feet, with the road-bed 12 feet above the surface of the water.

From the 96th mile the line follows the valley of the Assiniboine up to the mouth of the Qu'Appelle, at the 110th mile, with easy gradients, and the works would be light.

The bottom of the valley is about one and a-half miles wide, being prairie, interspersed with clumps of poplar, willow and brush; the soil is good. The south slope of the valley is wooded; the north slope is chiefly prairie, with some clumps of of poplar.

On a general average the works on this line would be moderate, the heaviest item being the earth-works, which is due to the sand hills on the first seven miles, and the heavy cuttings and embankments in descending to the valley of the Assiniboine.

### THE NORTH-WESTERN LINE.

This line is shown on the map herewith by the firm red line A E F G, from which it will be seen that for the first 10 miles it follows the same course as the line above described. Thence it diverges to the north-west, making a straight course to a point on the east side of the valley of the Little Saskatchewan, where the northern cart trail enters the valley. This is known as Tanner's Crossing, and a bridge has recently been erected over the river. This point is between the 33rd and 34th mile, and its altitude is 1,768 feet above sea level. The character of the country and the soil is very similar to that described on the parallel section of the other line.

The surveyed line crosses the valley of the Little Saskatchewan obliquely on a general course nearly west, descending the eastern slope to the river with a gradient of 32 feet per mile for 4½ miles, and ascending the western slope at the rate of 42 feet per mile for 5½ miles.

The excavations, however, are heavy, and in locating the line for construction it will be expedient to make a deviation by which the gradients on the eastern slope would be increased to 40 or 42 feet per mile, and on the western slope up to probably 52 feet per mile. This would shorten the line about 1½ miles and considerably reduce the earth-works.

The altitude at the 42nd mile, on the top of the western slope of the valley, is 1,867 feet. Thence the located line will be carried to a point half a mile south of Long Lake, from which it will make a straight course to the 89th mile on the top of the eastern slope of the valley of Bird-tail Creek.

From the 42nd mile the rise is gradual up to the 85th mile, where the altitude on the trail line is 2,007 feet, but on the located line it will be about 1,980 feet. The surface of the country between these two points is slightly undulating and indented with numerous ponds and lakelets, but the soil is of the richest quality. It has originally been covered with woods that have been destroyed by fire, and a few miles to the north the forest still prevails.

Throughout the whole space between the Little Saskatchewan and Bird-tail Creek the lands are being rapidly occupied on both sides of the line. The crops of wheat, barley oats and other agricultural produce were very heavy this season, but owing to the very wet spring they were unusually late.

The line descends the eastern slope of the valley of Bird-tail Creek obliquely with a gradient of 42 feet per mile for six miles, on which length the earth-works will be moderate. There will however be some trestle bridging in crossing two or three coulées formed by lateral streams.

Ascending the western slope of the valley to the 100th mile the maximum gradients on the trial line are 52·80 feet per mile, but these will be improved in location.

The slopes of the valley of Bird-tail Creek, where the line crosses, splay out to an angle of inclination very much less than where the trail crosses about seven miles lower down, on which the survey was made in 1877. The east side of the valley is open prairie dotted with groves of poplar. The soil is exceedingly rich and the crops of natural grass were astonishing, reaching in places over four feet in height.

Both of these are good colonization lines, but the north-western line will serve a greater breadth of fertile lands well supplied with good water which appear to be preferred by settlers, and it is within easier reach of the wood suitable for fuel and building purposes. Besides the saw and grist mill erected at Rapid City, others are being erected farther up the river north of both lines and nearer the timber limits, and others also near the sources of Bird-tail Creek.

The approximate bill of works will show that the cost of construction would be about the same, mile for mile on each line, but the north-western will cost less in the aggregate, being from 10 to 15 miles shorter than the other to the common point of intersection of the telegraph line about 60 miles west of Livingstone, and it will also have this advantage for through traffic.

This advantage in being the shortest line would be neutralized to some extent if the other line were carried direct from Fort Ellice, south of the Touchwood Hills, to the Elbow of the North Saskatchewan, but more than half the distance would be over a very poor and in some parts almost desert country of sand, gravel and boulders, the scant soil strongly impregnated with alkali.

It is probable that in extending the north-western line from Bird-tail Creek a considerable detour to the north, as shown by the dotted red line, will have to be made to reach the crossing of the Shell River at H, unless we can find a practicable crossing farther to the south.

This north-western line lies centrally between the Lakes Manitoba and Winnigosis on the north-east and the Assiniboine on the south, both of which are proposed to be navigated by a steamboat company; and notice is given in the official *Gazette* that application will be made in the ensuing session of Parliament for a charter for a railway extending from a point near the Little Saskatchewan, south-westward to the coal fields on Souris River. This would cross the Assiniboine above the Grand Rapids, from which point the river is navigable for craft of light draught up to Fort Ellice. By these means settlements on the borders of the Assiniboine would be facilitated, and a branch line of railway could be extended up the valleys of the Assiniboine and Qu'Appelle at small cost, whenever the increased business of the country required it.

This would seem to indicate that the north-western line would be of the greatest assistance in the settlement of the whole country between the Assineboine and Qu'Appelle on the south, and the Lakes Manitoba and Winnipegosis on the north.

I am, Sir,
Your obedient servant,
MARCUS SMITH.

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### REPORT ON AN EXAMINATION FROM THE END OF THE FIRST 100 MILES, SECTION WEST OF THE RED RIVER, TO OPPOSITE THE MOUTH OF THE LITTLE SASKATCHEWAN, BY MR. WILLIAM MURDOCH.

CANADIAN PACIFIC RAILWAY OFFICE,
WINNIPEG, 18th March, 1880.

SANDFORD FLEMING, Esq., C.M.G.,
Engineer-in-Chief, Canadian Pacific Railway,
Ottawa.

SIR,—In accordance with your instructions by telegram, dated January 9th, 1880, namely—"Want immediately to ascertain best direction for line from valley of Assiniboine, above rapids, to line under Ryan's contract, so as to avoid gradients adverse to coal traffic. Wish you to proceed as far as mouth of Little Saskatchewan, return, and report without delay."

I left Winnipeg on January 31st, and proceeded to the end of Mr. John Ryan's contract. I examined carefully the different routes from that point to the summit of the Big Plain, which is about eight miles distant. There the first steppe, ascending from the Manitoba plain to the higher plateau of the north-west is met, the rise being sixty-one feet, in about three hundred feet. From the boundary of the Province of Manitoba, to the base of the steppe there is a gradual rise in the plain of probably sixty feet more, making a total rise of about one hundred and twenty feet.

In the first half mile the line crosses a creek which overflows its banks during the summer.

The next half mile is over open, dry prairie interspersed with clumps of alder, and is part of the only good hay meadow near the Big Plain of any extent, and therefore very valuable to the settlement west.

The next mile is over level land, covered with poplar trees, through which a stream passes, along whose banks the trees are hung in profusion with fine wild hop vines, with the hops still upon them. This brings the probable course of the line to the south side of a muskeg, along which it might be constructed for the distance of a mile just where the slope meets the muskeg, on good sand bottom. For the next half mile the course of the line will be on the muskeg itself, then again on the margin of the same for one and a half miles, followed by one mile of ordinary work over small sand hills, covered with poplar trees and undergrowth in places.

This brings the line to the westerly ascent, which will be on side hill, to that portion of the prairie, known as the Big Plain. The side hill in places is abrupt, and is composed of sand, the character of which is so light that the wind has scooped it out in places and massed it into drifts. There is also some sandy clay loam, but the bulk of the material can be easily moved. To avoid heavy works on the side hill, which I chose as the most suitable approach to the Big Plain, will probably require the adoption of three degree curves at two places.

The next 27½ miles is on an open prairie with no gradients till you near the water-shed, which is perceptible in ascending easterly from Boggy Creek Marsh. At this place a grade of 15 feet to the mile, say for one and a-quarter miles, will overcome all adverse gradients. The whole of this plain, is, I am told by the settlers, taken up by people who are to occupy the land this spring. The soil in all cases where I made enquiries is said to consist of a sandy loam, having a top covering almost all over it of black soil. Wheat grows well, and I was shown good samples of plump grain. Good water is obtained at 32 feet below the prairie level. On Section 27, township 11, range 14, Mr. Olmstead dug a well, getting good clear water, digging first through two feet of black loam, then four feet of clay, then clay loam merging into coarse sand at the bottom of the well.

The course for the next six miles follows the valley proper of the Assiniboine River, as will be seen by reference to the accompanying map, on which the line of the proposed railway is laid down. This valley is almost level having a fall probably not exceeding six feet in the mile. It is about one and a-half miles wide at the Rapids and up to the Little Saskatchewan; below these points it widens out as seen on the map.

In selecting a crossing for the railway over the Assiniboine, I looked for the highest banks and narrowest waterway during freshets. The extent of the spring freshets is clearly defined, and in many places is from one-half to three-quarters of a mile in width. At these places, the flats are much lower than the bank of the river on one side, hence the overflow. At the point selected, the river channel has the advantage of being wider than at other places.

At this point I took a cross section of the right bank of the Assiniboine Valley to the prairie level, with the view to ascertain the summit to surmount, and found it to be 101 feet above the ice on the river; but the banks on the south side increase in height as you go westerly, so that there will be a still higher elevation to overcome. The side hill extends from the river bank south 2,200 feet, with easy slopes to ascend westerly.

Here the prairie has a level narrow bench near the summit, of two miles in length, which brings us opposite the mouth of the Little Saskatchewan, or as far as your instructions authorized me to go westward. Onward from there the prairie becomes more undulating, and of a rolling character, as far as the eye could see. It is an open plain only broken by the Turtle and Pembina Mountains, and the Blue Hills of Brandon which are in view.

On the map accompanying this report, the pink color represents sand hills. To avoid them and escape heavy work, the line is diverted, and I may mention that the length of line shown on the map, between Boggy Creek Marsh and the beginning of the Big Plain, is only increased five-eighths of a mile from a straight line.

Gravel for ballast can be got near the end of Mr. Ryan's contract, and at Boggy Creek, also on the south side of the Assiniboine.

The total length of line from Ryan's contract to the point opposite the Little Saskatchewan, is nearly 50 miles.

I trust that the plan and description of the line explored, together with the list of structures, and descriptive character of the work, will convey sufficient information to enable you to form a tolerably correct estimate of the work to be performed.

I am, Sir,

Yours faithfully,

WILLIAM MURDOCH,

*Engineer-in-Charge.*

### *List of Streams which require Bridging.*

1 Creek 3 feet deep and 20 feet wide.
1 do 8 do 30 do
2 do 6 do 15 do
Oak Creek 8 feet deep and 25 feet wide.
1 Creek 8 feet deep and 15 feet wide.

Assiniboine Bridge, 300 feet wide (with swing), bank on south side 19 feet above ice level, and bank on north side 10 feet above ice level; the high water or flood mark is 8 feet above ice level—only three feet of water in the channel of the river—gravel bottom.

1 Coulée crossing 60 feet wide, 14 feet deep.
1 do 100 do 30

Say 10 culverts of 6 feet openings.

### *Descriptive Character of Work to be Performed.*

No. 1. ½ mile of cross logging with bank on top.

No. 2. ½ mile of open alder prairie, dry.

No. 3. 1 mile of level land covered with poplar.

No. 4. 1 mile of easy side hill where line of railway would be constructed on the edge of muskeg on sandy soil, 5,000 cub. yards per mile.

No. 5. ½ mile of cross logging, over muskeg, sand bottom, with bank on top, say 2 feet.

No. 6. 1½ miles of easy side hill, similar to No. 4, 5,000 cubic yards per mile.

No. 7. 1 mile of ordinary work, say 10,000 cub. yards.

No. 8. 3 miles of side hill, sand and clay loam, easily worked, say 23,000 cubic yards per mile, to summit of Big Plain, on a grade of 30 feet to the mile ascending westerly.

No. 9. 27½ miles of open prairie, say 7,000 cubic yards to the mile.

No. 10. 6 miles of flats on Assiniboine Valley, say 6,000 cubic yards per mile.

No. 11. 6 miles of side hill, with levels, portions to prairie level on the south side of the Assiniboine, grade 30 feet per mile in places, 5,000 cubic yards per mile.

No. 12. 2 miles of level prairie, say 6,000 cubic yards per mile, to opposite mouth of Little Saskatchewan. Total distance nearly 50 miles.

Section of Little Saskatchewan River,—125 feet wide from bank to bank, 100 feet from water edge to water edge; bank 8 feet high, above ice level, on both sides, the flood level reaches within 1 foot of the top of the bank; 2 feet of water and ice, only four inches of water, gravel bottom.

### *Probable Location of Projected Railway Line.*

Commencing at the end of John Ryan's contract, say at the north-west angle of south-west ¼ section 7, township 13, range 12, 1½ miles north of the 4th base line.

Thence in a south-westerly direction to south-west ¼ of section 34, township 12 range 13, west.

Thence in a west-south-westerly course, according to location, principally on side hill to section 25, township 12, range 14, west, to the first steppe of the Big Plain, where a rise of 61 feet has to be overcome.

Thence to section 22, township 12, range 14, over prairie.

Thence to north-west ¼ section 12, township 12, range 15, over nearly a level prairie.

Thence west-south-west to south-west ¼ of section 3, township 12, range 16, west.

Thence in a south-westerly direction to south-west ¼ of section 12, township 11, range 17, west, close to the edge of the Boggy Creek Marsh, or left bank of the Assiniboine Valley.

Thence in a west-south-westerly course to the north-east ¼ of section 25, township 10, range 19, west, close to the left main bank of the Assiniboine Valley, close to George Laird's house.

Thence in a south-westerly course, across section 25, to the crossing of the Assiniboine.

Thence in a westerly direction along the side hill, on the south side of the Assiniboine, rising to the prairie level in a westerly and southerly direction to the north of Oak Lake.

WILLIAM MURDOCH,

*Engineer-in-Charge.*

# APPENDIX No. 16.

## DOCUMENTS IN REFERENCE TO THE BRIDGING OF RED RIVER.

*Letter from the Engineer-in-chief to the Minister of Railways and Canals.*

CANADIAN PACIFIC RAILWAY.
OFFICE OF THE ENGINEER-IN-CHIEF,
OTTAWA, 24th September, 1879.

SIR,—The letter dated 17th September, of the City Clerk of Winnipeg, and various other papers on the subject of a bridge across the Red River, having been referred to me, you have asked me to state my views as to the feasibility of bridging the river at the point determined upon by the City Council of Winnipeg, by resolution of the 16th inst.

The point selected by the City Council for bridging the Red River may be the best to be found in the neighborhood of Winnipeg, but there are difficulties which call for careful consideration. It is only too well known that on several occasions, within the recollection of people living in Manitoba, the Red River has overflowed its banks and flooded the ground on which the City of Winnipeg is projected. The several piers of a bridge might, to some extent, obstruct the channel of the river, and while certainly they would not facilitate the discharge, they might, if the site be injudiciously chosen, retard the flow of the water and increase the risk of flooding.

The river does not every year overflow and flood the adjacent country; indeed, I learn that it has not done so since 1861, but I am informed that recently the water has risen so high as to endanger some of the buildings near its banks.

I observe in the articles of agreement made between the Mayor and Council of the City of Winnipeg and the Manitoba Southwestern Colonization Railway Company, a clause, of which the following is an extract:—

" The said parties of the second part (the Railway Company) shall not be bound
" to take over or accept the said bridge from the said Government, unless they shall
" see fit to do so; and that in the event of the said bridge being swept away or other-
" wise totally destroyed after the same is handed over to them, the said parties of the
" second part (the Railway Company) shall not be bound to rebuild the same unless
" they shall see fit to do so."

This paragraph suggests the idea that the promoters of the Railway Company apprehend that the bridge may be carried away by the floods; it at least shows their determination to assume no responsibility in the matter.

The destruction of the bridge, whatever the loss, would be of little account when compared with the damage and destruction which would result to a populous city, on the site of Winnipeg, in the event of the flood water rising to the level which I am told it has reached on former occasions. And if at any future time the river flooded its banks to the same extent, it is not impossible that the damage done might be attributed to the establishment of the bridge and to the obstruction to the discharge of flood water caused by its piers, abutments and approaches.

I am about to proceed to Manitoba, and I shall, when on the spot, carefully make an examination and give the whole subject my best consideration. In the meantime I feel it my duty to point out the difficulties which surround the question, and to indicate the possible consequences for which the Government might be held liable if they undertook to locate and construct the bridge.

In view of these considerations, I am not at present prepared to advise that the Government should assume the responsibility of complying with the request of the City Council of Winnipeg.

I am, etc., etc.,

**SANDFORD FLEMING,**
*Engineer-in-chief.*

The Honorable
Sir Charles Tupper, K.C.M.G.,
Minister of Railways and Canals.

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### *Report of the Engineer-in-chief on the Bridging of Red River.*

Canadian Pacific Railway.
Office of the Engineer-in-chief,
Ottawa, 8th December, 1879.

Sir,—I have the honour to report on the several communications, from the Mayor and Corporation of Winnipeg, asking the Government to undertake the construction of a Railway Bridge across Red River, opposite the city. When the papers were first referred to me, I addressed to you a short report, of date September 24th, pointing out that the bridging of Red River was a matter requiring grave consideration, on account of the vast body of water, which, at times, inundates the locality.

Since I addressed you on the 24th September last, I have visited Manitoba and made a personal examination of Red River for nearly 30 miles of its course, through the Parishes of St. Boniface, St. Johns, Kildonan, St. Pauls, St. Andrews, St. Clements and St. Peters. Having carefully enquired into the facts respecting the periodical floods and the various local circumstances which affect the location of the bridge, I have now to report the views I have formed on the whole question.

When the water is as its ordinary summer level, the river ranges in width from 350 to 600 feet. It flows in a well-defined channel between banks from 20 to 30 feet high, and presents to a casual observer no extraordinary difficulty as to bridging. It seems, at first sight, that a comparatively placid stream, flowing for the most part gently in its course between moderately high banks could with ease be bridged at any required point. Investigation, however, brings out certain remarkable circumstances which demand serious consideration.

All, or nearly all, rivers in a northern latitude are subject to freshets at the period of the year when winter merges into summer. But on the Red River it appears that these freshets sometimes assume the form of floods, and these phenomena are occasionally developed to an alarming extent, and carry along with them wide spread devastation.

During my visit to Manitoba, I was favored with an interview with the Archbishop of St. Boniface. His Grace has resided in the country for a long series of years, and has had the advantage of witnessing the annual freshets, as well as several of the inundations. His Grace was good enough to afford me the benefit of his local experience. In the year 1852 the river overflowed its banks and completely submerged the level prairie for several miles on each side. The water rose until it stood at least 3 feet 6 inches above the general surface of the ground around the Palace of St. Boniface, and it seemed like a vast lake, extending in all directions. The whole country was submerged from Minnesota north to Kildonan. The site of the city of Winnipeg was completely under water, and the nearest dry land in that neighborhood was at Burke's farm some four miles away. The flood remained in this state for more than two weeks.

After an interval of eight years (in 1860) the river again inundated its banks, covering the level prairie, but the overflow was not widespread.

The following year (1861) there was another flood, when the water rose to within two feet of the level of the flood of 1852, overflowing to the depth of about 18 inches a very large area of the prairie.

Since 1861, there has been an immunity from any serious inundation, but on one or two occasions, the water has risen nearly to the prairie level.

The Bishop of Rupert's Land, in his " Notes of the Flood of 1852," estimates the breadth of the inundated country at about 12 miles; mentions that houses and barns, furniture and farm implements, were swept away. The settlers took refuge on the nearest elevated ground, Stoney Mountain and Bird's Hill. The Bishop, with his household, escaped in canoes, and passed down the river until he reached dry land, in the Parish of St. Andrews, some thirteen miles below Fort Garry. From this point northerly he describes the river as being " confined within narrow limits," and with a more impetuous current. The Bishop mentions that at the Stone Fort the river was " running at the rate of eight or ten miles an hour." Extracts from His Lordship's journal between May 3rd and June 8th are appended.

In " The Red River Settlement, its Rise and Progress," (by Alexander Ross) a work written before the inundation of 1852, we find an account of an earlier flood, of which the author was an eye-witness. This occurred in the year 1826, the water rose about 18 inches higher than in 1852, and submerged a much greater area of the level prairie. It lasted from the 2nd of May to the 15th of June.

I submit a few extracts from the volume referred to:—

" The winter had been unusually severe, having begun earlier and continued
" later than usual. The snow averaged three feet deep and in the woods from four
" to five feet. The cold was intense, being often 45° below zero; the ice measured
" five feet seven inches in thickness. Notwithstanding all this, the colonists felt no
" dread till the spring was far advanced, when the flow of water, from the melting of
" the accumulated snow, became really alarming. On the 2nd of May, the day
" before the ice started, the water rose nine feet perpendicular in the twenty-four
" hours."

* * * * " On the 4th, the water overflowed the banks of the river
" and now spread so fast that, almost before the people were aware of the danger, it
" had reached their dwellings. Terror was depicted on every countenance and so
" level was the country, so rapid the rise of the waters, that, on the 5th, all the settlers
" abandoned their houses and sought refuge on higher ground.

" At this crisis, every description of property became of secondary consideration
" and was involved in one common wreck, or abandoned in despair. The people had
" to fly from their homes for the dear life, some of them saving only the clothes they
" had on their backs. The shrieks of children, the lowing of cattle and the howling
" of dogs, added terror to the scene." * * * * * * " By
" this time, the country presented the appearance of a vast lake, and the people in
" the boats had no resource but to break through the roofs of their dwellings and
" thus save what they could. The ice now drifted in a straight course from point to
" point, carrying destruction before it, and the trees were bent like willows by the
" force af the current.

" While the frightened inhabitants were collected in groups on any dry spot
" that remained visible above the waste of waters, their houses, barns, carriages,
" furniture, fencing and every description of property might be seen floating along
" over the wide extended plain, to be engulfed in Lake Winnipeg. Hardly a house
" or building of any kind was left standing in the colony." * * * *
" The water continued rising till the 21st, and extended far over the plains. Where
" cattle used to graze, boats were now flying under full sail." * * * *
" It subsided, of course, very gradually. It was on the 15th of June that the settlers,
" for the first time, drew near the sites of their former habitations."

I have mentioned that Mr. Ross's account of the flood of 1826, was prepared for the press more than twenty years afterwards. By that time, the settlers had resumed their land, rebuilt houses and been led into a fancied security. They thought they had seen the last extraordinary rise of water to deluge the country. Mr. Ross, however, wrote the prophetic words " what has happened once, may happen again," and before his volume issued from the press, he had witnessed the inundation of 1852, and added a separate account of it in an appendix.

The following extracts may be given of an occurrence which submerged the locality and drove the settlers from their farms from the 7th of May to the 12th of June:—

* * * * " On the 7th of May the water had risen eight feet above " the high-water mark of ordinary years, overflowed the banks of the river, and " began to spread devastation and ruin in the settlement; boats and canoes in great " request for the saving of lives and property; all hurry, bustle and confusion; some " had to take shelter in the garrets, some on stages, some here, some there, in little " groups on spots higher than the rest, anxiously waiting a boat, a canoe, or some " friendly hand to save them from a watery grave. From 150 yards wide, the usual " breadth of the river, it had spread to three miles on each side and rose for several " days at the rate of nearly an inch per hour."

* * * * " On the breaking up of the river, the channel got choked " up with ice, which caused the water to rise seven feet in an hour or two. This " occurred at night after the people had gone to bed, and it came on them so suddenly " that, before they were aware of it, themselves and their beds were afloat, cattle and " sheep were drowned and two men, who had gone to rest on a small rick of hay, " found themselves in the morning drifting with the current, some three miles from " where they had laid down the night before. Others again, in the absence of canoes " or other assistance, had to resort to the house-tops; some took to the water and " hung to the branches of the trees and bushes, till daylight brought them relief."

* * * * " On the 12th, half the colony was under water and had " made a clean sweep of all fencing and loose property on both sides of the river, for " a distance of 22 miles in length. In all this extent, so low and flat is the country " throughout, that not a single house was excepted—all was submerged—not an " inhabitant but had fled."

* * * * " On the 22nd, the water was at its height, and the coin- " cidence is remarkable, inasmuch as on the same day of the month the water was " at its height, during the former flood, twenty-six years ago: but it was then 18 " inches higher than it has been this year; still, the people being fewer, the damage " at that time was less. During eight days before the change, dwelling houses and " barns were floating in all directions, like sloops under sail, with dogs, cats and " poultry in them. Outhouses, carts, carioles, boxes, cupboards, tables, chairs, " feather beds, and every variety of household furniture drifting along added to the " universal wreck."

* * * * " At its height the water had spread out on each side of " the river six miles, for a distance of fourteen miles in length—not a house was " excepted. Loaded boats might have been seen sailing over the plains, far beyond " the habitations of the people. The spectacle was as novel as it was melancholy. " Three thousand five hundred souls abandoned their all and took to the open " plains."

* * * * " The falling of the water allowed many of the people to " approach their cheerless homes about the 12th of June."

Our knowledge of these alarming, and too frequently devastating occurrences is limited, yet besides frequent freshets which have caused no great damage, we find a record of inundations which have swept over the country in the following years, viz:— 1776, 1790, 1809, 1826, 1852 and 1861.

The overflow of 1852 is so recent that it cannot fail to be remembered by all in the settlement who shared in the devastation and ruin which accompanied it.

On at least two other occasions the water covered the face of the country to a greater depth than in 1852, but the settlers were fewer, and, consequently, the damage was not so great.

The question may be asked :—

(1.) Is it probable that floods resembling those described will again occur?

(2.) If in the ordinary course of nature, a recurrence be probable, can any means be adopted, in the establishment of the Pacific Railway, to guard against the destruction of the works in this locality, and the serious interruption to traffic, which, without proper forethought and precaution, would certainly accompany such devastating occurrences?

These are questions of the gravest importance in connection with the construction of a thoroughfare across the continent, as a great national highway, and I shall endeavor to answer them.

When recently in Manitoba, I instructed Mr. Rowan to collect all measurements, plans and cross sections which had been made of the river, between the confluence of the Assiniboine and Lake Winnipeg, and to furnish all other data necessary to enable me to report definitely on the subject, for the information of the Government. Some years ago Mr. Rowan ascertained, as closely as possible, the height the floods had attained along the margin of the river, at different periods, since the settlement of the district.

The means adopted on that occasion are described in his communications of the 18th ultimo, which are attached. It is sufficient to state that the greatest care has been taken to obtain accuracy.

From the measurements and data furnished, the following table has been prepared, shewing, in a condensed form, much of the exact information which has been collected. I present the figures as I find them, but it strikes me there are some unimportant discrepancies, which can easily be accounted for and allowances made.

**TABLE** showing the heights above sea level, of the water and banks of Red River, at various places and at different times, etc.

| LOCALITY. | From mouth of Assiniboine River. | HEIGHT IN FEET ABOVE SEA LEVEL. General Prairie level. | Ice level of 1876. | Flood Level. 1875 | 1860 | 1852 | 1826 | Difference between ice level and Flood of 1826. | Flood of 1826 above prairie level. | Prairie level above Flood of 1826. | REMARKS. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Miles. | | | | | | | | | | |
| Mouth of Assiniboine........ | 0 | 764 | 732 | 750 | 765 | 767 | 769 | 37 | 5 | ... ..... | Submerged District. |
| Point Douglas ........ ........ | 2 | 762 | 732 | 750 | ...... | 767 | 769 | 37 | 7 | ......... | |
| North of St. John's Church. | 4 | 761 | 732 | 750 | 763 | 765 | 769 | 37 | 8 | ......... | |
| North of Kildonan Church. | 7 | 761 | 731 | 750 | 758 | 764 | 768 | 37 | 7 | ......... | |
| South of Tait's Creek... ..... | 12 | 759 | 730 | 747 | ..... | 759 | 766 | 36 | 7 | ......... | |
| Near St. Andrew's Church. | 18 | 759 | 723 | 742 | ..... | 751 | 759 | 36 | ......... | ......... | Contracted channel, with impetuous current during floods. |
| About 2 miles above S. Fort | 20 | 760 | ..... ... | ...... | ...... | 748 | 755 | ........ | .... .... | 5 | |
| Stone Fort... ............ ......... | 22 | 758 | 719 | 740 | ...... | 742 | 752 | 33 | ......... | 6 | |
| About 2 miles below S. Fort | 24 | 753 | ....... | 736 | ...... | 737 | 748 | ......... | ......... | 5 | |
| Selkirk............................ | 27 | 744 | 718 | ...... | ...... | 732 | 738 | 20 | ......... | 7 | |
| St. Peter's Church............ | 31 | 736 | ......... | ...... | ...... | 725 | 730 | ......... | ......... | 6 | |
| Lake Winnipeg............ ...... | 40 | ......... | 716 | ...... | ...... | ...... | ...... | ......... | ......... | ......... | |

In attempting to account for these periodical inundations, the first idea that strikes the mind is that they may be due to the rising of Lake Winnipeg from some cause, probably the choking of its outlet by an ice-jam during the transition period between winter and summer.

The backing up of the waters of the lake is, however, fully disproved by the above table, an examination of which will show that the overflowed portion of the river has stood, during floods, more than 40 feet higher than Lake Winnipeg. During these periods, the facts brought out likewise establish that the river was an impetuous torrent for some six miles above and a considerable distance below Stone Fort.

The table shews further that, at times, the flood-water of the river has stood above the general level of the prairie over the whole district to the south of Tait's Creek, and that no part of the river banks, from St. Andrews to the lake, has been inundated. This perfectly agrees with recorded evidence, by which it appears that when the river overflows its banks and devastates the country for miles on each side, the inundations have only extended northerly to the neighborhood of Tait's Creek, in the Parish of St. Andrews. That, while hundreds of square miles have been flooded south of the Parish of St. Andrews, there is no record of any overflow from St. Andrews, northerly, to Lake Winnipeg.

The extraordinary increase in volume of the water of Red River, which periodically devastates the country, has been the subject of various speculations.

Mr. Ross states with respect to the flood of 1826, that "the previous year had "been unusually wet; the country was thoroughly saturated; the lakes, swamps and

" rivers, at the fall of the year, were full of water; and a large quantity of snow had
" fallen in the preceding winter. Then came a late spring, with a sudden burst of
" warm weather, and a south wind blowing for several days in succession; the snow
" melted at once, and Red Lake, Otter-Tail Lake, as well as Lake Travers (sources of
" Red River) all overflowed their banks."

These causes are sufficient to account for the superabundance of water:—A wet fall, followed by sudden, severe frost, to seal up the marshes, lakes and saturated ground until spring; an unusual snow-fall during a prolonged winter; a sudden burst of warm weather, with copious rain in the basin of Red River.

In ordinary years, the climatic conditions are different, and any one of the causes mentioned might be insufficient to produce any disaster, but a combination of them at any time would, in all probability, result in as great a discharge of freshet water as at any past period. We may thus account for the superabundant flow of water, but something more is required to explain the circumstance that the waters accumulate and remain for weeks, covering hundreds of square miles, at the level of 40 feet above the lake, into which the river directly flows.

An examination of the country between the inundated district and the lake, reveals the remaining condition necessary to account for the widespread overflow.

A person arriving at Winnipeg will observe that the banks of the river are of a soft and yielding character, easily acted on by the elements. They are of clay, but the clay is somewhat of the character of quicksand. They are subject to slides and alterations of form. In consequence of the constant changes that take place, a marked increase in the width, between the river banks, has taken place within the past fifty years. Similar changes have occurred at many places along the course of the river, as far north as the Parish of St. Andrews. But here the character of the banks change, they are no longer soft and yielding, on the contrary, they are firm and strong; in more than one locality a ledge of rock presents itself.

Generally, through the Parish of St. Andrews, and for some distance below Stone Fort, the trench through which the river flows remains contracted, and its appearance indicates that no perceptible change takes place from year to year. Indeed, it is highly probable that this portion of the river is practically the same, in sectional form, as it was many years ago, and its banks are so firm for many miles, that no material change can be predicted.

To the limited dimensions of the river channel, through the Parish of St. Andrews, may be attributed the inundations—the contracted water-way prevents the free discharge of surplus water, in periods of floods; the immediate consequences are the raising and backing of the flood water, until the whole country to the south becomes submerged. The raising of the water at the upper end of the submerged outlet is productive of another result, viz., the impetuous current described by some of the witnesses, in the contracted channel, at and above the Stone Fort. Another remarkable circumstance may be mentioned. It appears that when the channel through the Parish of St. Andrews becomes gorged, and the water backs up to a certain level above the prairie to the south, the flood water finds an overflow to Lake Winnipeg, some miles to the west of Red River, by passing up Tait's Creek to a depression known as the Big Bog, and thence by Netley Creek. This natural overflow will account for the non-submergence of the country north of Tait's Creek.

It is clear, from the foregoing, that the inundations have been produced by natural means, which are still in force, and that in the ordinary course of nature we may expect a combination of these causes to produce results similar to those which have occurred in the past. It is futile to assume that Red River shall never again overflow its banks. Man is utterly powerless to prevent its occurring periodically, and whenever it occurs the disastrous consequences will be intensified in proportion to the increased number of inhabitants within the submerged district.

It is essential that all the local circumstances should be known and most carefully weighed in determining the proper site for our great continental line of railway this part of Canada. If, without due consideration, or regardless of the local experience which has been gained by many now living, we were to carry the Railway

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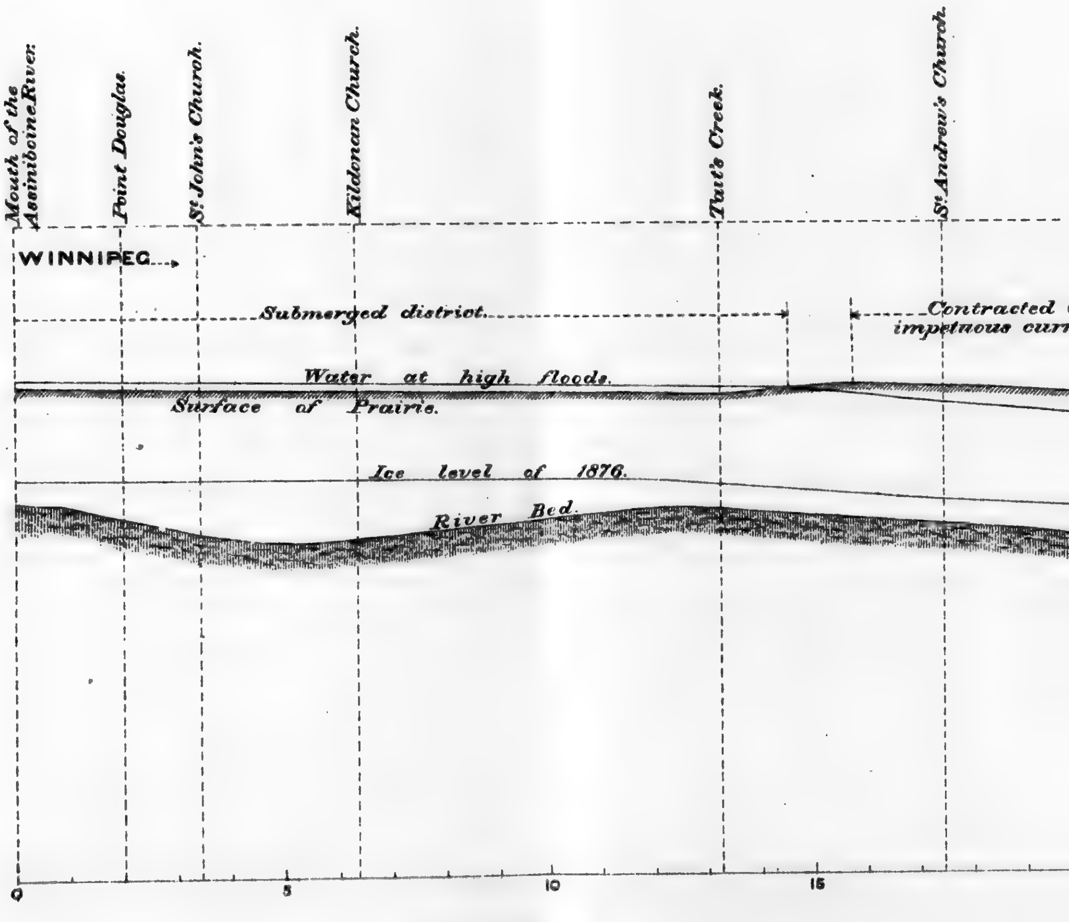
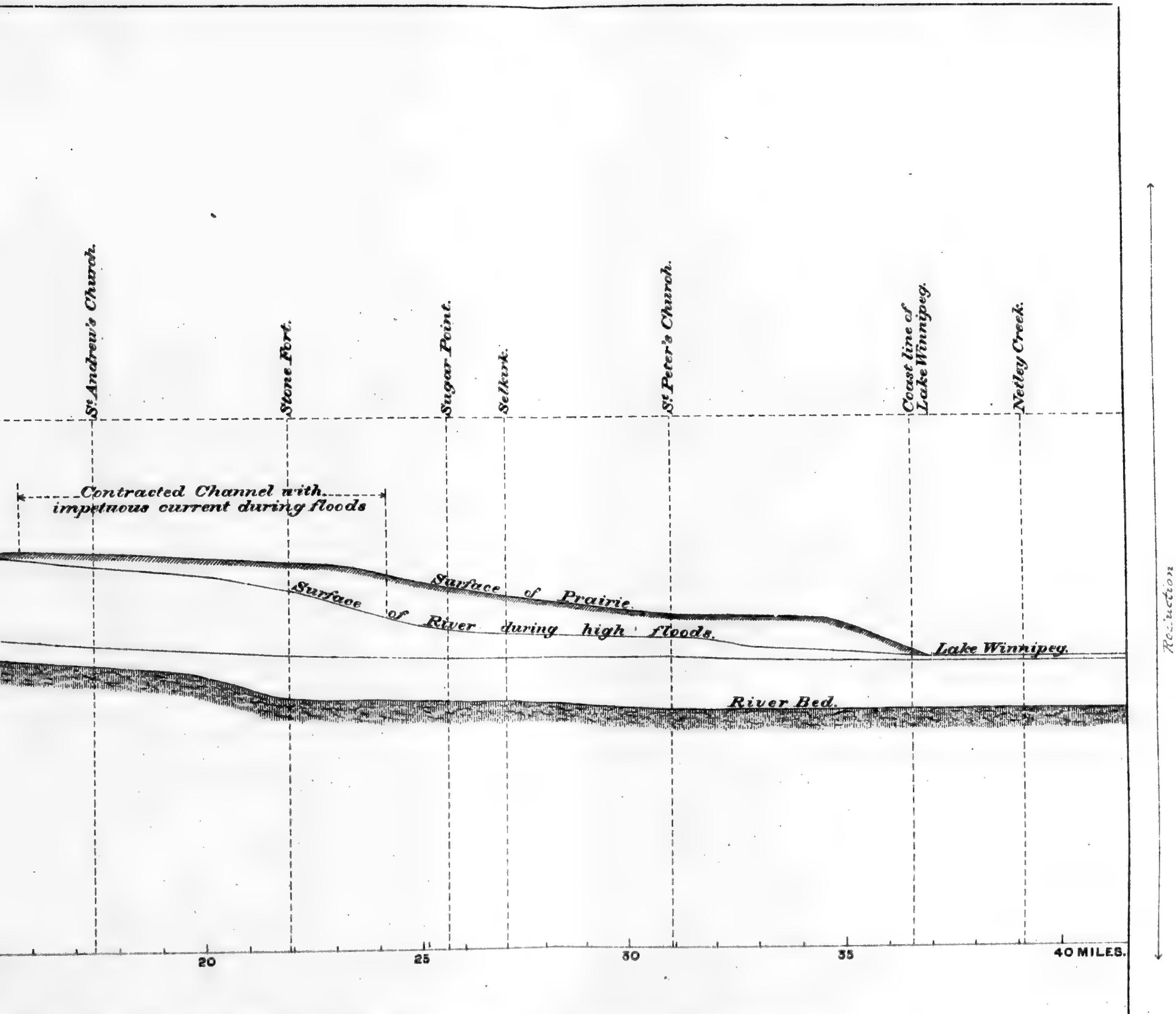


*Longitudinal Section of Red River fr*
*showing Submerged Dis*

PHOTO LITH BY THE BURLAND LITH CO. MONTREAL

**Plate No. 6.**



*Red River from the City of Winnipeg to Lake Winnipeg*
*ubmerged District during High Floods. etc.*

across Red River anywhere in the district subject to inundation, we might any year find a dozen miles of the line for a month or more submerged, the bridges and approaches swept away, and traffic stopped until the whole be restored. Similar consequences might follow if, to avoid the flooded district, we bridged Red River at St. Andrews or Stone Fort, where during seasons of extreme high water the stream is an impetuous torrent. It would not be easy to plant piers that would prove permanent in such a position, without making them enormously expensive, and no piers could be built without obstructing the water-way, already too contracted. The immediate consequences of still further narrowing the outlet would be to impede the discharge and prevent the easy escape of the water, thus increasing the tendency to overflow up stream involving serious questions of damages, whenever a disaster occurred.

On giving the whole subject serious attention and weighing every consideration that seems to control the selection of a point for crossing Red River, I am forced to the conviction that the main line of the Pacific Railway should pass at some distance to the north of Stone Fort, where the banks recede and allow ample space for the passage of flood water. The bridge should not be too near the foot of the current which emanates from the gorged channel between St. Andrews and Stone Fort. It should be in comparatively still water. I find such a locality between Sugar Point and St. Peters, within a distance of four miles.

In fixing on the precise point of crossing, other considerations, less important than those above referred to, demand some attention.

In establishing the railway in this district, the traffic which in future years may come by water from Lake Winnipeg and the rivers and streams flowing into it, should not be lost sight of. In order to accommodate this traffic, the railway should be so situated that steamers and sailing craft may easily be brought side by side with the railway cars during the whole season of navigation.

Red River may be considered sufficiently deep from the Lake to Stone Fort to allow vessels to pass up to the latter place, but above Stone Fort, owing to rapids, the river is not navigable for lake craft, at low water.

The river at Stone Fort being in a contracted channel, it would be a matter of difficulty to carry the rail-track to the ship's side, and impracticable, without encroaching on the water-way, to find space for piling lumber, etc., and transferring cargoes, Moreover, below Stone Fort, for two or three miles, the river, owing to the sharp bends around Sugar Point, is not well suited for the use of sailing craft. From the last turn in the channel below Sugar Point to the lake, the course of the river is comparatively straight and can with greater ease be navigated by craft of all sorts.

Wherever the railway forms a convenient connection with the deep water of the river, that point will practically become the head of navigation of Lake Winnipeg. In course of time a busy town will spring up and the land on the town site will assume a value it never before possessed. To the north of Sugar Point, in the locality designated Selkirk, a block of more than 1,000 acres remains ungranted and under the control of the Government—this is probably the only block of land along the whole course of the Red River which has not passed into private hands or into the possession of the Hudson Bay Company.

This large block of land abuts on the river, where a bridge may be constructed with least apprehension as to the safety of the structure in time of floods, and where its erection could, under no circumstances, involve questions of damages. Near the river there is a natural deep water inlet, which can easily be reached by a short branch from the main line of railway; along this inlet, and between it and the river the land is admirably suited for a capacious piling ground. Vessels lying in the inlet are in no way exposed to damage from floods; in proof of which, it may be mentioned that the Hudson Bay Company have used it as a place of shelter for years past. They have no land, or buildings, or other property here, but they have found no safety in the open river near their establishment at Stone Fort, and at this moment the steamer *Colville* and another vessel, all the craft the Company have in these parts, are moored for the winter in the inlet, which indents the Government block of land. Thus there cannot be a question as to the eligibility of this point for sheltering shipping in winter, as well as for the purposes of navigation in summer.

In conclusion, I may be permitted to say that these various considerations, in my judgment, control the location of the railway, and, guided by the facts I have endeavoured to lay before you, I am not able to recommend the Government to assume the responsibility of bridging Red River at any point where the proposed structure would be seriously imperilled, where prolonged interruption to traffic might be looked for on the occurrence of a disaster, the imminence of which no one can judge. I am strongly of opinion that the Pacific Railway should be carried across the river somewhere between Sugar Point and St. Peters Church, and the circumstances which I have briefly described dictate that the crossing should be on the block of Government land at Selkirk.

I have the honor to be, sir,
Your obedient servant,
SANDFORD FLEMING.
*Engineer-in-chief.*

The Honourable
Sir **Charles Tupper**, K.C.M.G.,
Minister of Railways and Canals.

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## *Notes of the Flood at the Red River, in* 1852. *By the Bishop of Rupert's Land.*

### EXTRACTS.

Its effects were very different in different places; they varied almost with every reach of the river, and according to the level of the bank at each spot, It was perhaps the most disastrous among the Canadians around and above the "Upper Fort"; it was very severe in the upper and middle Church districts; it affected a good deal the lower part of the Assiniboine; while the upper part of the district of St. James on that river and those of St. Andrew's and the Indian Settlement, were almost untouched.

*April* 25*th.*—The winter had been unusually fine until the end of February, but through the whole of March a great deal of snow had fallen, which seemed sufficiently to account for the present rise.

*May* 3*rd.*—These expectations were encouraged by the very slight rise during the night, but from 10 a.m. till 2 p.m, the water gained so fast as to lead to very painful forebodings. Some houses opposite to us are already abandoned, their inmates tenting on the little knolls behind. We hear of one settler taking a bateau right through his house. From the Fort we hear that more than fifty deserted houses may be seen.

*May* 4*th.*—Rode up to the Fort the sight very distressing. The bridges are all giving way.

*May* 5*th.*—Towards night heavy rain commenced, the first since the breaking up of the ice.

*May* 7*th.*—Horses of the Company pass down; sent for security to the Stone Fort. They were seen fording and swimming the creeks, now swollen to rivers. In every direction there are processions of cattle, horses and carts going to the Little Mountain, the creaking sound of the wheels is melancholy to hear. One stable drifts down the river.

*May* 8*th.*—During the forenoon a little snow and sleet fell. * * Water still rising.

*May 9th (Sunday).*—We had heard over night that the waters were stationary at Pembina; but the great rise in the night dispelled such a pleasing idea. Many had hoped to defer the removal of their cattle till after the day of rest, but were forced to go off at once. * * I prepared for service but with a heavy heart. The pathway to the Church was open, but only just so; the waters had entered one corner of the churchyard, and had the service been three hours later, we could not have gone over dry shod. The gathering of the congregation was very different from usual. Some came over their cornfields in the large boat.

"*Et ducunt remos illic, ubi nuper ardrant.*" Others were ferried across the creek where my bridge was many feet under water.

The strength of the south wind is bringing down a prodigious volume of water.

The most melancholy sight of the day had been when those tented on my grounds moved off, and passed over the swollen water to the north side of the church. All walked right through the stream, men and women up to their waist; the cattle were swum over, and the carts with great difficulty got through.

The Red River opened for itself fresh channels into the Assiniboine above the junction, so that from Pembina to our settlement was a broad lake, and it came down upon us—as an Indian, I believe, first expressed it—like a race horse.

*May 10th.*—Another beautiful morning, but the rise in the night greater than any previous one. The water was now in the granary and store, and I was some time standing in the water.

They were distressed at finding us so surrounded with the waters. Their accounts were most painful. The barn of Emilien, the largest farmer among the Canadiens, had floated away; they reported, also, the loss of many other houses, carried down by the current.

A poor Frenchman called on me, begging for a little relief; his house had been swept away, and besides this, he was left without a bateau; he was houseless, and spoke of his seven children with tears in his eyes, but he added—"*C'est le bon Dieu qui m'a affligé*"—a lesson of patience to all.

We ascended the high raft of wood, to take a prospect around. How desolate! not a creature visible to the eye, save one neighbor, with his wife, on the top of their raft. Boats, too, were seen in unusual places, still carrying cattle over.

*May 11th.*—The rise in the night rather less; the platform was now floating. My garden, the last dry spot, was now under water, and the churchyard, the seed-plot for eternity was also covered.

*May 12th.*—It was a melancholy sight to look down from the gallery, and as I viewed the churchyard laying under water, I thought what could be done in case of death. There had been two funerals the day before at St. Andrews; what could I do if death occurred in the upper settlement? The rise of the night had been very great, and the wind was strong from the south-east. This caused a violent current against the house, which we could hardly stem on our return from the church.

*May 13th.*—After a most tempestuous night, a bright morning; the wind falling, but still considerable. The rise much as before; not one dry spot below; no resting place for the sole of the foot. We had prayers in the kitchen, standing in the water three inches deep. What devastation this one night must have made? If we felt somewhat alarmed, what must it have been for those exposed to the severity of the weather?

The nearest resemblance to our condition might be found in a prolonged shipwreck, in which the waters are fast gaining on the vessel, and one knows not what to rescue and save, or whether the ship itself will hold out to the end.

*May 14th.*—Rose at half-past four, the weather still stormy. The men, however, said, "*Keche nootin, mahiah kwinskitin*"—It blows hard, but it is fair. We started soon after five. My sister was brought in a wooden bateau from the foot of the stairs through the hall and kitchen, and thus got into the birch-rind canoe.

We went right over the fields—nearly the line of our usual land-road—to avoid the strong current and long winds of the river. After a hard paddle, we reached our refuge at Mr. Taylor's, where many came out to welcome us. * * * After dinner I rode up to the encampment on the little mountain, where I saw Captain Hill and the pensioners. Found Mr. Black and Dr. Cowan there also, who confirmed the good tidings of a diminished rise.

*May 15th.*—The cold of the previous day had almost prepared us to expect the snow and sleet which fell this morning, and continued for some hours—a most wintry aspect for the middle of May. Nearly thirty had slept under the roof, females and children being taken in from the tents around; on one occasion as many as thirty-five.

An evident decrease in the rise of the water,—a great mercy; for, had it continued at the same rate, a very few days must have driven us from our present refuge, and tents were being prepared in the expectation that we would yet have to pitch out. Mr. Taylor arrived in the evening and reported one boat-load of our property taken down to the Rapids; the boat to return on Monday for more should the rise still continue.

*May 16th (Sunday).*—A fine, cold morning. After breakfast, proceeded on horseback to the Little Mountain, and found that Captain Hill had made the necessary preparations, and selected a spot sheltered, as much as possible, from the north wind. Before me was a table, covered with a scarlet cariole cloth, by which I stood for service. The congregation formed in a semi-circle around, consisting of pensioners, their families, and other settlers, about 100 in all.

*May 17th.*—I started early in the canoe to visit my own house. In passing the Fort, called to see the Mayor and Mr. Black. At the Fort gate the current was terrific, and we entered with difficulty. Instead of the usual bustle of May—the most active month of the year—all was desolate; boats were within the quadrangle, and one taking in cargo from the upper windows of the store. Breakfasted with Major Caldwell; after which the rapidity of the current soon carried me to my own house.

On leaving the church tower, the boat went through the churchyard gate, and for some distance kept its course over the plains; but, on getting into the current of the river, the tide was so strong against us that we made but little head; and after trying for some time to stem it, to little purpose, I urged Mr. Hunter to return, and hailed my canoe, into which I jumped, and got up in safety, through God's blessing. The waves were so high as almost to threaten to swallow us up.

*May 18th.*—A boat came to take some provisions and seed for our use above; but little, comparatively, could be done while the waves were so high, and the house so deep in water and difficult to pass through. The heavy porch of oak had floated off, and the boat was now moored close by the front door.

After a hard pull, we arrived in safety, but all were sadly afflicted at the loss of our valued and trusty cook. The rest of the day was spent in realizing the delight of being on dry land, and enjoying all the pleasures which the unwearied kindness of our friends could afford.

*May 19th (Indian Reserve near Selkirk).*—All was energy around; we seemed to have passed to another atmosphere. Ploughing was going on on both sides of the river. In a walk before breakfast, saw the seed being committed to the ground; while, on the other side of the road, the wheat was already up. Seven ploughs were at work in one field, and five or six in another, those whose land was dry feeling the necessity of cultivating on a larger scale. The children were engaged in clearing and preparing the little garden around the parsonage.

*Submerged District.*—Mr. Chapman's account of the losses in his own district was very appalling. The houses of two brothers had been entirely swept away, with their barns and wheat; while along a considerable space on the other side of the river there was not one house left standing.

*May 21st.*—The river still stationary. The height, on the whole, is certainly not so great as in the former flood, perhaps by about eighteen inches; but as the channel of the river is deeper and broader, and the creeks very much enlarged, there may be an equal volume of water. Delighted to find that the water had sunk an inch in my own house. I started to pass the night there. We had a most beautiful sail. The river was like that of a vast lake studded with houses, of many of which the projecting gable was the only part visible. The calmness of the evening gave an increased hope; there was a young crescent moon, and the water was falling slightly in the house.

*May 22nd.*—A beautiful morning. There was still a decrease in the water; a flag was hoisted at Oak Lodge, a signal to give the good news, according to agreement, to those on the hill.

*May 23rd (Sunday).*—Noticed the calmness and activity of the day. There was a better congregation, owing to the beauty of the day, between 250 and 300. The day was intensely hot.

*May 24th.*—Strange sights met our eys as we proceeded. Some of the bridges we saw four miles below their former locality, and on the opposite side of the river. The railing round some of the graves of the Upper Church had also been carried down as far. A barn had been tied to a strong tree, to secure it, but it eventually floated off. The houses, many of them standing up to the eaves in water, showed less the destructive effects of the water upon them than some weeks after when the waters had retired.

Here (at Park's Creek, half way between the Middle Church and the Rapids) the current, from being confined within narrow limits, became more impetuous, and we had been strongly advised to proceed by land, but not being timid on the water, and having confidence in the skill of our three men, we preferred going on to the Rapids.

The rapidity of the current almost made one giddy to look at it, it was running at the rate of eight or ten miles an hour.

*May 25th.*—The breadth of the whole expanse of water was supposed to be, in some places, twelve miles—this instead of our usual narrow river!

*May 26th.*—Went down to our house in the morning; gratified to find only twenty inches of water, instead of forty, in our rooms.

*May 27th.*—There was a little refreshing rain and a fine evening, when I took a gallop up to the Little Mountain. Had tea with Mr. and Mrs. Logan, and from them obtained what I had much desired, a copy of the "Missionary Register" for December, 1826, with Mr. Jones' account of the former flood.

*May 28th.*—The morning being more promising, the boat came, and we went up to survey the river above Sturgeon Creek, but a shower came on and prevented us from fully accomplishing our plan, and we returned home well drenched.

*May 29th.*—A lovely morning afer the storm. The first sound that greeted me on awaking was the pleasing word "*Pahstazoo*"—It is dry. I went over to the church, entering still by the window, and found that the pulpit and reading desk had now regained their proper position.

*May 30th (Whit-Sunday)*—A morning of very heavy rain. It was doubtful for some time whether I could start for service, but the rain gradually lessened, and I determined to make the attempt.

*May 31st.*—The closing day of another month, in the language of the country, the flower month; to-morrow, the commencement of the heart-berry or strawberry month.

*June 1st*—Rode up to the mountain to bid farewell. * * * Beaver Creek boats passed down to day.

*June 2nd*—Rode up to Sturgeon Creek to see those there before leaving; a pretty spot, and large encampment. Many were out; all busy preparing for the departure of the boats.

*June 3rd*—Started from St. James early with my family; left our kind friends with regret; we had a quick run down; the land is fast reappearing. The chief fear now is the slip of the bank; many houses are supported and propped up, lest the earth should launch forward and carry them away. Reached the parsonage at St. Andrews about five.

*June 5th.*—This morning we were surprised by Major Caldwell's arrival; his first visit down during the flood. The day was somewhat stormy.

*June 7th*—Soon after we had dined, I started off by canoe for my own house to see Mr. Pridham once more before leaving for England. * * * * The chief feature which I noticed as novel was the pyramids of clay in front of the houses, as the people were shovelling out the mud left within from their chimneys having given way and fallen in. We were late in reaching the upper settlement, but on getting near the house we were so overjoyed at the sight of the stubble fields, which appeared dry to the eye, that we determined to try the land and make a short cut acr[illegible] We soon repented of our rashness, finding at each step that we sunk deep [illegible] the treacherous mud.

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## *Report on Bridging Red River by Mr. James H. Rowan, District Engineer.*

CANADIAN PACIFIC RAILWAY,
MANITOBA DISTRICT ENGINEER'S OFFICE,
WINNIPEG, 18th November, 1879.

DEAR SIR,—I send you by express to-day a tracing of the plan of Red River, between the City of Winnipeg and the lake of that name, together with a longitudinal section of the river between the same points, and cross-sections at the several points which have been selected by various parties as the most favorable for a railway crossing.

I forwarded to your office, about two years ago, a plan with some of the information here given. Some additions have been made at your suggestion, to the information then given, and others which I thought desirable, in order to make the matter more complete. The obtaining of this additional information is the cause of my not being able to forward the plan sooner.

On the longitudinal and cross-sections are shown the surface of the ground at the upper or prairie level (the levels of the bottoms or intervals in the banks of the river are shown by figures in circles on the plan), ice or low-water level, the high-water levels of 1826-52-61. No ordinary high-water level is given, because so far as our own observation and enquiries are concerned, it varies every year; but it may be stated in general terms as from 15 to 20 feet at Winnipeg, and from 3 to 8 feet at Selkirk below the flood level of 1852.

I may here state that in re-plotting the levels of the high water of 1852, a clerical error was found, in those laid down on the plan and profile sent you years ago, by which the level was made too high at that point.

The course followed in order to obtain accurately the water levels now given (and which are all reduced to a common datum of "sea level," according to the latest corrections in my possession) was as follows:—A series of B. M.'s were established at various points along the river bank, and connected by levelling with those on the line of railway. A party, consisting of an Assistant Engineer and Rodman, following the course of the river went first to one of the oldest inhabitants in the neighborhood, when a level was to be obtained and got him to point out some mark to which the water had risen; as soon as he was gone, another party was applied to who pointed out some other mark; these were subsequently tested with the level, and in most cases, found to agree very closely. The same course was followed at each point where levels are shown. As no authentic information could be obtained of the H. W. of 1826 at A, no level is given.

No information could be obtained of the H. W. of 1861 beyond the point C, the reason assigned being that north of that point it was not much above ordinary H. W. as to attract special notice.

As you have quite recently been over the whole of the ground yourself, it is not necessary that I should trouble you with details of the topography in this report I shall therefore only call your attention to some general facts bearing on the subject.

The banks of the river, throughout the portion under consideration are very similar in character, the top being the black soil of the prairie for a depth of about four feet, underneath this is a bluish white laminated clay, of great depth as a general rule, interspersed here and there with thin veins of sand or gravel varying from 1 to 2 inches in thickness. At a depth of 50 or 60 feet below the prairie level this clay has a considerable quantity of boulders, of various sizes in it. This clay when dry is extremely compact and solid, it has however a great affinity for water, and when brought into conjunction with it, absorbs a large quantity and becomes like bird lime. At some points on the river, sometime on one bank, then on the other and occasionally on both, the banks are covered from low water level to 10 or 15 feet above it, with stones varying from 1 to 6 or 8 inches in diameter. This is noticeably the case from 2 or 3 miles above "St. Andrews Rapids" to the "Lower Fort."

At two points on the river, viz:—Cross Sections No. 6 and 9, rock *in situ* is found and has been used for building purposes, but at the first named point it can only be quarried at low water.

Owing to the nature of the clay above referred to, it has, when brought in contact with the water, been forced out into the river at low-water level, by the weight of the superincumbent earth, and is carried down to the lake, where it has formed an extensive "bar" at the mouth of the river, having only from 4 to 6 feet of water over it at low water. The oozing out of this material from under the banks causes them to crack and settle down almost perpendicularly; these cracks sometimes occur as far back as from 100 to 300 feet from the outer edge of the bank. By this settling down, the material which otherwise would not be disturbed to any great extent by the current or ice, becomes disintegrated, and is easily carried away by the freshets and ice.

Owing to this cause the river valley is much wider at many places than it was fifty years ago, but there are numerous points between here and the lake where, from some unexplained cause, this action does not seem to have occurred to any extent.

There is an extensive swamp known as "the Big Bog," which, commencing at the western limit of the city, extends northerly to Netley Creek, near Lake Winnipeg; at Selkirk it is 7 miles west of the river.

About 13 miles from here, Tait's Creek, a large coulée drains a portion of this swamp into Red River. You will observe that at this point the great flood levels begin to fall away more rapidly, and from here northward to the neighborhood of the lake the country has not been under water on these occasions. This is no doubt due, amongst other causes, to the fact of the water of the river on these occasions flowing out through this valley into the big bog from which they found their way into the lake though Netley Creek.

While from this point southward to some distance south of the International boundary, and for a considerable distance on each side of the river, the whole has been seen covered to a depth of several feet, by persons still living here.

It is said by persons whose residence in the country is only of a more recent date, that such floods will never occur again as the river bed has widened sufficiently to prevent them. It is to be hoped that such events may not again occur, but if they do not, the above will not be the reason, for, as already stated, there are several points between here and the lake which are little, if any, wider than they were 50 years ago.

I have given this whole subject a great deal of consideration since I first came here, and my opinion is that these stages of extraordinarily high water are due to a combination of events which are, I think, as follows:—1st. A series of wet seasons (such as we have had for the last two years.)

2nd. Very severe and continued frost before the snow falls, causing very thick ice on the river.

3rd. A heavy snow fall, during the latter part of the winter, throughout the area of country which drains into the river.

4th. The breaking-up of the winter accompanied by heavy rains in Minnesota, while from here to the north it continues cold so that the river does not open up at its outlet.

Any one of these events is not sufficient to cause a flood here, but the whole coming together would, undoubtedly.

From the information we have been able to obtain, the place appears to have been on these occasions more like a lake than a river, from which I infer the principal obstruction to the flow of water has been beyond the point already referred to—Tait's Creek—and a man living in the neighborhood of the Stone Fort stated that he had seen the ice so piled up on the river at that point as to prevent his seeing the opposite shore.

So much discussion has occurred of late on the subject of the location of a bridge at Winnipeg, and the selection of Selkirk as the point of crossing, that I shall make a few remarks on these two subjects before closing this report.

As has already been stated, the backing-up of the water over the site of this city, seems to have been caused, to some extent, at least, by obstructions further down stream.

On inspecting the accompanying plan, it will be observed there is a triangular piece of land extending from the H. B. Fort, on the Assiniboine, towards Point Douglas, which is several feet below the general level of the surrounding country.

There are a large number of buildings and a number of the principal mills and manufactories on this level. On two occasions since my coming to reside here, the high water has been just up to the level of this flat, and a slight additional rise would have inundated this portion of the city, and caused a large amount of damage. As it was, a sash and door factory was obliged to shut down in consequence of the water filling their boiler pit.

Were a bridge built at Point Douglas, and should the water again rise to the level, or possibly higher in consequence of obstruction caused by the piers of the bridge, it might not unreasonably be claimed by parties sustaining damage to the south of it, that the bridge was the cause of the backing-up of the water, which would give rise to serious claims for damages. This is, of course, leaving out of consideration altogether that such a jam of ice might occur there as would cause the inundation of that portion of the city standing on the higher level, and the ice does now jam to some extent at this point every year.

If, on the other hand, a bridge were built at Provencher Avenue and Broadway, and an embankment formed from it on the line of Broadway to Main street, and the water should rise so as to cover the low ground north of it, a claim could not be raised with any show of reason that the bridge was the cause, until the water had risen high enough to overflow the embankment, by which time it would be over the country, on both sides of the river, for some distance.

The section of the river at the Stone Fort would seem, at first sight, to present a very favorable crossing, but owing to the circumstance already named, and the fact of its being very costly, if not impracticable, to form a connection between the railway and the water level of Lake Winnipeg, for freighting purposes, while the banks of the river at and for some distance below this point are so high and close together that sailing vessels could not work their way up to it from the lake ; and, in addition, the current here is very swift. In view of the fact that the conveyance of freight by way of Hudson's Bay is now a subject of serious consideration, such a connection becomes a very important fact. The land in this locality is all in private hands.

At Selkirk, a bridge, although somewhat longer than at the last named point, would not require such high piers. By the construction of permanent trestle-work, across the valley on the east side of the river, all danger of obstructing the free flow of water during floods would be avoided, while the trestle-work would be completely protected from the action of ice by the natural conformation of the ground, and the fact, as stated by all who were questioned on the subject, that, by the time the ice reaches this point, it is very rotten and broken up into pieces of small size.

The low ground, above referred to, and the conformation of the river would afford an admirable site and facilities for the construction of a large extent of wharf accomodation, which could be reached from the railway level at small expense; while the lower banks, wider and straighter valley, and slight current of the river admit of *sailing vessels* as well as steamers easily reaching this point. This is demonstrated by the fact of their constantly doing so, bringing in lumber from the lake and unloading it at the village of Selkirk, which has sprung up on the west bank since the line was located here.

The land on the east side of the river is held by the Government, and has been now, for some years, surveyed and laid out as a town plot, for which it is admirably suited, and from the sale of lots in it, if a bridge across the river were built, sufficient and more than sufficient funds could be realized in time to pay for the expense of building the bridge there.

I remain, dear Sir,
Yours truly,
JAMES H. ROWAN.

P.S.—Borings at various points of the river, including Selkirk, have demonstrated that a good foundation for a bridge can be obtained at any of the places indicated, at a moderate distance below the bottom of the river.

J. H. R.

SANDFORD FLEMING, Esq.,
Engineer-in-chief.

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*Report of the Engineer-in-Chief on documents advocating the Bridging of Red River at the Lower Stone Fort, laid before the Government by Mr. C. J. Brydges, Land Commissioner Hudson's Bay Company.*

CANADIAN PACIFIC RAILWAY.
OFFICE OF THE ENGINEER-IN-CHIEF,
OTTAWA, 10th February, 1880.

SIR,—I have the honor to report on a letter adressed to the Right Honorable Sir John A. Macdonald by Mr C. J. Brydges, on the question of bridging Red River.

Mr. Brydges is an officer of the Hudson's Bay Company, and doubtless has in view the interest of his employers, in advocating the bridging of Red River at Stone Fort, where there is a large tract of Hudson's Bay land.

Mr. Brydges encloses a number of statements, by officers and servants of the Hudson's Bay Company, with the view of establishing that there is no difficulty in bridging Red River at Stone Fort.

These statements are by the following gentlemen:

1. J. Balsillie, of the Hudson's Bay Land Department, Winnipeg.
2 Wm Flett, Hudson's Bay officer, Lower Fort Garry.
3. Edmund R. Abell, Chief Engineer to the Hudson's Bay Company, Stone Fort.
4. James French, groom to the Hudson's Bay Company, Lower Fort Garry.
5 Norman Morrison, formerly in the service of the Hudson's Bay Company, Lower Fort Garry.

I have examined these several statements, and I have written my observations on the margin, for your information.

The statements submitted bring out no facts that do not confirm the conclusions that I have arrived at in my report of 8th December last.

It is stated by several of the witnesses that an ice jam has occurred at Sugar Point, at a place which, on reference to the plan, I find is some 1½ or 2 miles above the proposed crossing at Selkirk.

It is stated that the Hudson's Bay Company's vessels when moored in the Inlet at Selkirk, received on one occasion, some injury from a rise in the water. This may have been the case, and it tends to show how much the river generally is exposed to danger at certain times and how important it is to have a place of shelter where so little damage appears to have been suffered. The fact that Hudson's Bay officers have annually wintered their vessels in the same place, and that their vessels are now wintered there, goes far to show that there is no safer winter quarters for them in the river.

It is stated that the Stone Fort has never been submerged. This agrees with the information I have already submitted. One witness quoted by Mr. Balsillie (Mr. McDermott) testifies that the water rose on one occasion to within several feet of the top of the banks. From this it is clear, that at extreme floods the water rises more than 30 feet. This is quite enough to indicate the difficulty there would be in erecting piers that would withstand the force of the swollen current, and in view of the causes and consequences of the inundation, it would in my judgment be out of the question to augment the disasters, even in the very slightest degree, by placing obstructions in the already too contracted water-way.

There is no doubt in my mind as to the most eligible site for the Pacific Railway bridge, and the documents now submitted only confirm the view I hold, but, for argument sake, if we assumed that at the Stone Fort there exists a site, in every respect as good as at Selkirk, there are other circumstances which the Government will recognize the importance of. At Selkirk there is a large block of land (over 1,500 acres) belonging to the Crown. In my report of 8th December, I have said its area is over 1,000 acres, but it is really more than 1,500 acres. This block is admirably adapted for a town site and it would be greatly enhanced in value by the location of the bridge within its limits. At Stone Fort the Government does not now control a single acre of land, and any benefit to property from the establishment of the bridge at that place would accrue to individuals, and mainly to the Hudson Bay Company where they have 1,750 acres.

I enclose a sketch showing the relative position of the 1,500 acres Government land at Selkirk and 1,750 acres at Stone Fort which, the Surveyor General informs me, belongs to the Hudson's Bay Company.

I have the honor to be, Sir,

Your obedient servant,

(Signed) SANDFORD FLEMING.

*Engineer in-Chief.*

The Honorable
Sir CHARLES TUPPER, K.C.M.G.,
Minister of Railways and Canals.

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COPY *of Letter from Mr. C. J. Brydges to Hudson's Bay Company's agent, at Winnipeg, asking for certain information.*

HUDSON'S BAY COMPANY,
MONTREAL, 19th January 1880.

DEAR SIR,—I want you to get and let me have as soon as possible the following information: 1st, the date when our Post at the Lower Stone Fort was first established.

2nd How long any of our people now there have been at the post.

3rd Their statements as to the condition of the river at the High banks where the post is. As to the greatest height below the top of the bank that they have known the water rise during the freshet time. Also as to the manner in which the ice runs through the gorge when it breaks up in the spring. Has it ever been known to gorge or block the channel in the break up in spring. Has the ice ever been known to jam at that point so as to throw the water back higher up the river and thus flood the prairie. It is stated that this has been the case in some years. Also I should like to know how high up the banks or rather how many feet below the top the ice has been known to rise on its breaking up in the spring. It is stated that the river at our post has been so filled with ice that a person standing at our Fort could not see the bank on the other side.

As soon as you get this, go down at once to the Lower Fort and get full statements upon all the points I have named. Get the parties to sign the statements and state how long they have been there.

Write me fully and quickly, but do not use the wires about it.

I want the exact facts, whatever they are.

Yours truly,
C. J. BRYDGES.

J. Balsillie, Esq.
Hudson's Bay Company,
Winnipeg.

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*Letter from the Hudson's Bay Company's Agent at Winnipeg to Mr. C. J. Brydges.*

Hudson's Bay Company,
Land Department,
Winnipeg, 28th January, 1880.

Dear Sir,—Immediately on the receipt of your letter of the 19th instant, I proceeded to the Stone Fort in order to obtain the information required by you, as to the state of the river at that place during the breaking up of the ice in the spring of the year. This information is embodied in the enclosed statement from five parties who have resided for a number of years at, or near, the fort. The statements were taken separately and not in the presence of each other, and the coincidence, in almost every particular, is sufficiently remarkable to warrant implicit credence in what is stated. I believe from the conversation I have had with these and other parties, that these are the simple facts of the case and can be further verified if necessary.

About two hundred yards above the south wall of the fort, there is a small creek or *coulée*; the bed of this creek is about twenty feet below the top of the bank, and right in the bottom of the creek, and about thirty feet from its mouth, the Company have erected buildings which have stood for a long number of years. A portion of these buildings was at one time used as a distillery, and another part was used as a saw and grist mill, of which the grist mill is now in operation. During the freshets, water from the river had invaded the lower flats of these buildings, but not to a damaging extent, and there is no evidence of the ice ever having done the slightest injury. This will go to show conclusively, that the water or ice in Red River has never been sufficiently high to do these buildings any damage, or else they would not be there.

The Lower Fort was first established as a trading post, about the year 1829, although the stone walls were built much later.

I have just had an interview with Mr. Andrew McDermott, who came to this country in 1812, and who has resided for a number of years in the Red River settlement and who has undoubtedly a greater knowledge of local matters than any other person now living.

He was employed in bringing down the wood from Baie St. Paul with which to build the first buildings there, and although he has never resided at the Stone Fort, is conversant with the changes in the river at that place.

He informs me that he has never known, nor has ever heard from any one of the river or ice ever having approached within several feet of the top of the bank and that during the flood of 1826, of which he was a witness, the Stone Fort was quite free from inundation or damage by ice.*

I do not think there is anything more to be said on the subject.

Yours truly,

J. BALSILLIE.

C. J. BRYDGES, Esq.,
Montreal.

*Statements made by officers and servants of the Hudson's Bay Company in reference to the state of Red River at Stone Fort and other points, with marginal remarks by the Engineer-in-Chief, C.P.R.*

LOWER FORT GARRY,
27th January, 1880.

JOHN BALSILLIE,
Hudson's Bay Company.
Winnipeg.

SIR,—It gives me great pleasure to give you all the information in my power regarding your inquiries about the state of the river and the breaking up of the ice at this place.

I have naturally given the subject much attention, and from personal observation and information obtained from reliable sources, can speak authoritatively on the matter. Taking your queries as presented, the following are my statements:—

1st. I have resided continuously at the Stone Fort for the last twelve years, and during that time have seen no ice jam at the Stone Fort or in its immediate vicinity. The ice has broken up gradually and no sudden rise of the water to any extent has taken place. (*a*)

(*a*) This is 12 years experience, the extraordinary floods were before this period.

2nd. The highest that I have seen the water at this place was on the 24th April 1876, when it came to 15 feet from the top of the bank. This was occasioned, not from any jam at the Fort or near it, but from a stopping of the ice at the Sugar Point 3½ miles below the Stone Fort and in close proximity to Selkirk. This is the only place near the Stone Fort where the ice jams it may be said every year more or less. (*b*)

(*b*) This ice-jam is reported to have occurred about two miles above the proposed site of bridge at Selkirk.

3rd. Three years ago the ice jammed at the point below Selkirk and flooded all the low lands on the east side of the river opposite Selkirk, carrying the ice through the woods, causing considerable damage to our craft, which were then lying in their winter quarters in the slough on the east side of the river near Selkirk. (*c*)

(*c*) This may be correct, but it does not appear that a better place for wintering the H. B. craft exists on the river, as they still use it and have had two vessels wintered here during 1879-80.

4th. I have never known the ice to jam at the Stone Fort or its vicinity thereby causing the water to flood the prairies to the south. (*d*)

(*d*) This gentleman has only been some 12 years at the Stone Fort.

5th. I have never known the ice to pile on the banks at or near the Stone Fort except on very low points near the Stone Fort, simply because such a thing could not possibly have happened, without the water had overflowed the bank, and the man from near the Stone Fort who told Mr. S. Fleming that the ice at that point was piled so high that a person standing on one side could not see the other shore must have a abhorrence to tell the truth. (*e*)

(*e*) No man told S. Fleming this, it was mentioned by an old settler to Mr. Rowan. One who witnessed it during an extraordinary flood. This person *James Taylor* was for a period of twelve years in the H. B. Coy's employment.

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* In report 8th December, 1879, to the Minister of Railways and Canals by S. Fleming, the height of the prairie above flood level of 1826 is given at six feet.

6th. Although not at the Stone Fort, during the floods of 1852 and 61., I was then in the Red River Settlement and an eye-witness to both, and from marks made on buildings by myself personally, I can state that the flood of 1852 was four feet higher than that of 1861.

I am,
Yours truly,
(Signed) WM. FLETT.

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I, **Edmund R. Abell**, Engineer-in-chief to the Hudson's Bay Company, make the following statement:

I have resided at Lower Fort Garry since the year 1865, and have a thorough knowledge of the Red River of the North, having navigated the same from Breckenridge in the State of Minnesota, United States, to its mouth at Lake Winnipeg, since 1861. I have seen the break up of the ice on the Red River at the Stone Fort for the last fifteen consecutive seasons. During all these years I have seen no ice jam at the Stone Fort or in its vicinity, but have known it to jam several times at Sugar Point, (*f*) about three and a half miles below the Stone Fort causing the water to rise at the Stone Fort. The highest I have known the back water to rise at the Stone Fort from this or any other cause is to within twelve or fifteen feet of the top of the bank. I have also known the ice to jam at the first point below the village of Selkirk, (*g*) causing the water to overflow the low land on the east side of the river to a depth of ten feet and forcing the ice back up the creek where our vessels were lying, and driving them for a considerable distance from their moorings, and actually stranding one of the vessels on top of the bank. (*h*)

(*f*) The jam took place about 2 miles above the proposed bridge crossing at Selkirk.

(*g*) No statements to the contrary have been made The back water does not rise high enough to affect the bridge. The site would be in still water.

(*h*) And yet the H. B. Co's vessels are annually taken back to the same place and at the present moment are moored there. The bank at this spot is only some two or three feet above water.

From my knowledge of the configuration of the banks of the river at the Stone Fort, I do not think it possible for a jam to take place, nor have I ever known any ice jam below the Fort so as to raise the water to force the ice over the top of the bank.

As regards the flow of ice, it is so broken, and smashed up passing over the St. Andrews Rapids, that there are no pieces of sufficient size to cause an *ice jam at the Stone Fort.* (*i*)

(*i*) Is this consistent with the statement made respecting the ice forming a jam after it passes Stone Fort?

(Signed) ED. R. ABELL.

Stone Fort,
Manitoba, 27th January, 1880.

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**James French**, Groom to Hudson's Bay Co., Lower Fort Garry.

I have resided at the Stone Fort continually for the last fifteen years, and have seen the ice break up each spring.

I have never seen any jam of ice at this point, nor the water or ice rise higher than within fifteen (15) feet of the top of the bank. This rise is caused partly if not altogether by the ice jamming at a place called Sugar Point, and at a point further down.

And the ice jamming at Sugar Point is a yearly occurrence. I have never seen any great rush of ice past this Fort, it being broken up into small pieces coming over the St. Andrews rapids. (*k*)

(*k*) This and the preceding statement are not perfectly consistent.

I should think that the rate of the ice current does not exceed (5) five miles an hour, and this only from the giving way of the ice jam below.

I have never myself—or heard of any person else—having seen the ice on the top of the bank or near it.

STONE FORT, January, 27th 1880.

his
JAMES X FRENCH.
mark.

(Signed) JOHN SMITH, }
" JOHN HOWISTON, } Witnesses.

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I, Norman Morrison, of St. Andrew parish, blacksmith, formerly in the service of the Hudson's Bay Company, do make the following statement.

Have resided at or near the Stone Fort, since the year 1859 and have seen the ice break up in the river every spring during that time.

I have never seen the water rise higher than from 15 to 20 feet to the top of the bank, (*l*) and the highest stage of the water has generally been after the ice has gone.

(*l*) In Mr. Basillie's statement, he quotes Mr. McDermott as having seen the water within several feet of the top of the bank.

I think the year in which the water rose the highest was in 1861, the year of the flood.

I have never seen the ice jam at the Fort, nor any nearer than at Sugar Point three and a half miles below. (*m*)

(*m*) The point where the jam is said to take place appears to be fully 2 miles above the Selkirk bridge site.

This is the obstruction which causes the rise at the Fort.

I have never seen the ice piled on the top of the bank nor any thing near to it.

When the ice breaks up it generally begins in the centre of the river and gradually drops to pieces.

The swiftest current at this place is about five miles an hour.

(Signed) NORMAN MORRISON.

Lower Fort Garry, }
20th January, 1880. }

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John L. Smith of Dynevor, in the County of Lisgar, Province of Manitoba, makes this day the following statement:

1st. During the year 1852, I was a resident settler in North St. Andrews in this Province. Witnessed the height of water in the river that spring, and to my certain knowledge it did not reach the top of the bank at the Stone Fort by at least ten feet. (*n*)

(*n*) This level is six feet higher than the level mentioned in report 8th Dec. 1879.

2nd. That from the year 1867 to the year 1871 I was in the Hudson's Bay Company's employ, at the Stone Fort, and saw the ice break up fourteen springs in succession, and can safely say that during that time I did not see any ice jam at the Stone Fort, except when brought to a stand by the ice jam at Sugar Point. I have lived in the Red River settlement for fifty-four years, and can state positively, without fear of contradiction, that during that time the water has not overflowed the banks of the rivers at the Stone Fort, nor has any other living person seen it, nor have I ever heard that it has done so. (*o*)

(*o*) Perfectly in accord with the statements made.

3rd. From repeated observations at different times during high water, and the breaking up of the ice in spring a person on foot at a smart walk can keep abreast of an object floating down stream, and I don't think the current, at the Stone Fort, can exceed four or at most five miles an hour. (*p*)

(Signed) JOHN L. SMITH.

Town Fort Garry,
27th January, 1880.

(*p*) This may be during ordinary freshets, not during floods.

# APPENDIX No. 17.

REPORT ON SURVEY OF FRENCH RIVER DURING 1879, BY MR. E. P. BENDER.

OTTAWA, 29th January, 1880.

To SANDFORD FLEMING, C.M.G.,
Engineer-in-Chief, Canadian Pacific Railway.

SIR,—I have the honor to submit the following report of the survey of French River made last season in accordance with your instructions of May 22nd, 1879.

The harbor of French River, on the north shore of the Georgian Bay, was carefully surveyed by Mr. Ridout in 1875. His plans show a channel not less than a quarter of a mile wide and 30 feet deep. There seems to be an impression among some steamboat captains on the Georgian Bay that the harbor is difficult of access in the fall of the year on account of the prevailing west winds, while others maintain that there is no better harbor on the north shore. These conflicting reports induced me to examine the matter, and I was somewhat surprised to find that stakes placed by Mr. Ridout's party near the water's edge in 1875, were still standing in many places throughout the harbor. It would be hard to find stronger evidence of the excellent shelter which this harbor is capable of affording vessels than the fact that the ice and storms since 1875 have not carried away small stakes placed almost at the water's edge and retained in position by a few small stones. (Plan No. 1.)

French River, from its mouth to its source, in Lake Nipissing, covers a distance of about 50 miles, and is, in reality, a chain of very deep lakes separated by narrow bars of rock which dam back the water, thus forming rapids and cascades. These vary in length from 50 to 600 feet. The usual width is from 400 feet to a mile and the usual depth from 30 to more than 100 feet. The banks are steep, bold and rocky. In the broad expanses between the rapids the shores are indented at short intervals by deep bays, which, not unfrequently, extend inland for several miles. Hundreds of islands are scattered throughout its length, and lend a charm to that lonely region.

From the mouth, the course is north-east for a distance of two and a half miles. Here the river, turning suddenly to the east, is crossed by two bars of rock which, by preventing the free passage of the water form the rapids called Les Petites Dalles. These rapids, which have a total fall of 4·16 feet, present more serious difficulties than any other portion of the river. The centre line of the located channel is a reversed curve with a radius of 650 feet, the channel itself being 100 feet wide. The first lock with a lift of 6 feet would be at the foot of these rapids. (See Plan No. 2.) About six miles from Les Petites Dalles, at the upper end of an expansion of the river, called Lac Le Bœuf, from which there are three large discharges into the Georgian Bay, the channel divides into two branches, one to the left called the South Branch, which extends some 16 miles to Cantin's Bay, the terminus of the late Georgian Bay Branch; the other, through which nearly the whole volume of water passes, follows the general course of the river to the second rapid, 10 miles from Les Petites Dalles. In this distance there are three narrow passages, each about one hundred and twenty-five feet wide, the remainder being from five hundred to 1,500 feet in width. A few rocks would have to be removed and the channel straightened in one or two places. At the second rapid, which has a fall of two feet, and is 362 feet wide and six feet deep at low water, the second lock is located with a lift of 14 feet. The river is straight, about 500 feet wide and 30 feet deep, from the second rapid to the Recollet Falls, a distance of five miles. These falls are formed by a bar of rock about 100 feet wide, which obstructs the channel at this point. They are 7·97 feet high (Plan No. 4). Above the Recollet Falls there is an unbroken stretch of water 18 miles in length, from 400 to 1,500 feet wide, and from 30 to more than 100 feet deep. There are two small discharges from the main channel into the south branch; one branches off three miles from the Recollet, runs south one and a half miles, and falls through a narrow pass into Cantin's Bay, an expansion of the river. The other leaves seven miles from the Recollet, runs south for three and a half miles and empties into the south branch through the Horse Shoe Falls. Both these discharges have high banks, and are not more than 30 feet wide and two feet deep at ordinary low water. Cross-sections of them, at the site of proposed dams, are given in sheet No. 5. Two and a half miles from the Recollet there is a bay which extends north one and a-half miles, and receives the discharge of the north branch, which here enters the main channel, after having left it some 20 miles farther up. After these 18 miles, there are five rapids in the next five miles. The first of these, Le Parisien, fall 1·27 feet, is little more than a strong current, but since the channel is crooked, considerable excavation would be necessary (Plan No. 6). Seven thousand feet farther on are Les Petites Faucilles, a number of small currents, with a total fall of 1·62 feet, running in several channels separated by islands. The third lock, with a lift of 14 feet, is located in a narrow pass, with steep rocky banks, near the head of these currents, (plan No. 7). The Buisson Rapid, fall 4·65 feet, 3,000 feet from Les Petites Faucilles, is a straight and narrow channel of the required dimensions, with perpendicular banks of rock (Plan No. 8). At the Double Rapid, fall 3·05 feet, 3,800 feet farther on, the river turns suddenly to the left. The located channel, with a radius of 650 feet, passes through a small watercourse to the left of the main channel; for a distance of 400 feet the work would be rather heavy (Plan No. 9). Half a mile above this rapid, there is a small current with a fall of 0.26 foot, where the removal of a few rocks would be necessary (Plan No. 10). The fourth lock is located at La Grande Faucille Rapid, 4,000 feet from the last mentioned current. The fall is here 5·15 feet, and the lift of the lock 14 feet (Plan No. 11). The Pine Rapid, the last of the five, is 4,000 feet from La Grande Faucille, and has a fall of 2·52 feet. The waterway is of the required dimensions, so that no excavation would be necessery (Plan No 12). At the head of the Pine Rapid a beautiful lake meets the eye. To the left, at the bottom of a deep bay, the distant outlet of the north branch can be discerned, which, after a course of 23 miles, empties into the main channel, two and a half miles above the Recollet Falls.

To the right, a short distance from the head of the rapid, there is a branch which re-enters the river below La Grande Faucille, cross sections of these branches, are shown in sheet No. 12, at points where dams would be constructed (see also No. 13, the general plan of the river.) A little further on, the main channel turns to the left, while directly opposite the head of the rapid are innumerable islands densely wooded with lofty pines, thickly scattered in groups and clusters on an area of two miles square. Behind these islands one of the outlets of Lake Nipissing rushes down a steep incline, and is lost in the still waters below. Following the main channel for eight miles, through groups of islands and broad lakes, we arrive at the Chaudiere Falls.

In this distance the depth is nowhere less than 24 feet, and is usually more than 100 feet; the width varies from 500 feet to three-quarters of a mile. On leaving Keeso's Bay, at the upper end of this lake, 2,000 feet from the Lower Chaudiere Falls, the channel becomes narrow and winding, and it is necessary to leave the river and cut through the narrowest part of a spur of rock, around which the river flows (Plan No. 14.) At the Lower Chaudiere, fall 13·19 feet, the river rushes down between perpendicular banks of rock, scarcely 50 feet apart. In this narrow pass the fifth and last lock, with a lift of 14 feet, is located. Between the Lower and Upper Chaudiere there is a basin 2,000 feet long, with an average width of 500 feet. The Upper Chaudiere, fall 12·96 feet, is a succession of small rapids and deep currents, running in a narrow channel between steep and rocky banks. Although the depth of water is generally sufficient, the channel would have to be widened and straightened in several places. (Plan No. 14.)

There is probably no river which presents so many advantages for canalization as French River, for there are always at least two channels; by damming one the water below the dam would assume a lower level, and works be carried on above, which would otherwise have to be done under water; or a lock can be built in a favorable part of the river and the channel permanently blocked, as proposed at the Chaudiere, Grande Faucille and other rapids, while the whole discharge passes through the other branch. The river might be lighted by placing at each point a red light to the right and a white light on the left, so that a vessel ascending would pass to the right of the white, and to the left of the red light. In this manner, navigation would be as safe at night as in day. Perhaps it would be found advantageous to have a small steam skiff and two men between each lock to attend to the lights, and thus greatly reduce the number of lighthouse-keepers. (Plan No. 15.)

There is no building stone on French River fit for the masonry of locks, consequently it would, perhaps, be advisable to construct them of wood and iron in place of stone.

No. 16 is a plan and elevation of one of the proposed locks of 14 feet lift. The sides are wooden frames filled with concrete. The gates are strong, and firmly braced iron frames which slide in grooves, and have their up-stream surfaces covered with sheet iron, to prevent the passage of water.

Each gate is raised into position by two or more concentric cylinders, which slide one within the other. That at the head of the lock is composed of a single frame and two cylinders, one fixed and one moveable. Water is compressed into the stationary cylinder by a pump, worked by a small turbine wheel, and its pressure against the piston-head of the sliding cylinder raises the gate into position. That at the foot of the lock consists of two frames and three cylinders, two moveable and one immoveable. The water, as before, is forced into the fixed one, and its pressure upon the piston-head of the innermost cylinder raises the frame which forms the upper part of the gate until the piston comes into contact with the top of the other sliding cylinder; from this point the two cylinders move together, carrying both frames with them, until the gate is raised into its place. In this way the gates can be raised and lowered very rapidly, and by one man. Annexed is a table of quantities and structures from Georgian Bay to Lake Nipissing, with their estimated cost.

At the head of the Upper Chaudiere, the level of Lake Nipissing is reached. The first twelve miles of the lake much resembles French River. The least depth in a channel from 500 feet to a mile wide is 22 feet, and for six miles bottom was not reached with 110 feet of line. At 12 miles from the Chaudiere the lake becomes so wide that the opposite shores are scarcely discernable. For the remainder of the distance to the south-east coast, about 18 miles, the existence of a fine straight channel was ascertained, having a minimum depth of 17 feet.

Besides frequent soundings, an apparatus which I have called a Rock Seeker was employed to detect the presence of rocks and shoals. It consists of a horizontal bar 25 feet long firmly held in position, 14 feet below the surface of the water. The apparatus was attached to a boat which was rowed in mid channel, and consequently any depth less than 14 feet could not remain undiscovered. (Sheet No. 17).

No. 18 is a profile of the river and Lake Nipissing. Diagrams showing the temperature for the months of August, September and October are also given.

The following is a table of distances from Chicago to the seaports of Montrea and New York by different routes:—

| CHICAGO TO NEW YORK. | Rail miles. | Water miles. | Total | In favor of French R. |
|---|---|---|---|---|
| *Via* Lakes and Erie Canal | 0 | 1419 | 1,419 | 440 |
| " Lakes to Buffalo, rail to New York | 422 | 925 | 1,347 | 368 |
| " All rail | 961 | 0 | 961 | 0 |
| CHICAGO TO MONTREAL. | | | | |
| *Via* Lakes and St. Lawrence | 0 | 1,348 | 1,348 | 369 |
| " French River to Lake Nipissing, thence to Montreal by rail | 354 | 625 | 979 | |

This table shows that French River possesses decided advantages over any of the other routes from Chicago to the seaboard. The returns of the Chicago Board of Trade show that 63,593,687 bushels of wheat and other grains were shipped by the Lakes to Buffalo, and thence to New York by railway and canal.

The French River route, being 440 miles shorter than by the Erie Canal, and 368 miles shorter than the combined rail and water route to New York, would certainly attract a large portion of this enormous trade. The forests of pine which border upon Lake Nipissing have as yet scarcely been touched, so that the return trade, which largely influences the rates of freight, would be very large.

I have the honor to be, Sir,

Your most obedient servant,

E. P. BENDER.

# APPENDIX No. 18.

## REPORTS ON EXAMINATIONS MADE NORTH AND WEST OF LAKE NIPISSING, IN CONNECTION WITH THE PROJECTED RAILWAY EXTENSION TO THE EASTERN END OF LAKE SUPERIOR.

### *Report on Survey during* 1879, *by Mr. W. A. Austin.*

OTTAWA, 1st March, 1880.

SANDFORD FLEMING, Esq., C.M.G.

DEAR SIR,—I have the honor to report that on the 30th of April last, I received verbal notice from you to hold myself in readiness to proceed on certain work required to be performed for the Department of Railways and Canals.

I, therefore, in the ensuing month had tents and other necessary things made and prepared, so that no delay should arise as soon as my staff was named to proceed at once to the scene of operation.

On the 20th of May, I was notified that my staff was appointed.

On the following day I left Ottawa for Pembroke, where I procured my first five weeks' supply of provisions, with cooking utensils, axes, three boats, &c., &c.

On the 26th, my party was fully made up, numbering in all thirty-eight. On the following day we left Pembroke, per steamer, for Deux Joachim, and having made the portage, we reached the Roche Capitaine the same evening per steamer "Keepawa."

On the following day (28th), at 11 p.m., we got to Mattawa, bringing all our stuff with us.

We remained at Mattawa during the 29th, putting our provisions into convenient packages for portaging, and purchased another boat.

On the following day (Friday), we left Mattawa and reached the first portage on the Vase River from Lake Nipissing on Monday, June 2nd, where we camped.

The 3rd of June was spent in testing instruments and grinding axes, and portaging provisions over this long portage.

Starting from a point about 20 feet above the surface of Lake Nipissing, 404 feet east of the South-East Bay, and near the deep-water landing, I examined the country and ran a trial location survey, in a north-westerly direction, towards Long Lake, a distance of 63 miles.

From the aforementioned starting-point the grade rises to the 40th station (¾ mile), making use of side hill and the valley of a small stream, thence generally level to the 110th station (2nd mile), over swampy ground with some rocky knolls. thence descending to the 160th station (3rd mile).

Generally, the timber, for this distance, is red and white pine with maple, tamarac and spruce, cedar and poplar; some of the swamps have but little wood upon them.

Again, the country is generally level to the 260th station, crossing the Clay Brook at station 168 and the Vase River at 216th station.

From the 260th station the most direct line, and shorter by one and a-half miles, would lead through a level, swampy country with but little rock to encounter and some few clay and sand hills. But on account of the low level of the swamps, some parts being only 5 feet above the assumed low-water of Lake Nipissing, this portion had to be abandoned.

Your instructions directing that a height of 20 feet should be kept above Lake Nipissing in the event of the Ottawa and Lake Huron Canal being built. Consequently, at the 260th station, the line bears more northward, running over some swamps and rocky knolls, side hills, &c., reaching the western shore of Side Lake at station 352 ($6\frac{5}{8}$ mile). Thence along Side Lake generally rocky to the 370th station (7th mile), then at the 377th station the line reaches Cross Lake, which for 660 feet will have to be crossed by a trestle bridge, the greatest depth of this lake is thirty feet, the water surface being 22 feet above Lake Nipissing.

From this the ground generally rises, and at station 540, attains a height of 110 feet above Lake Nipissing. At the 506th station, the Chippewa River is to be crossed by a bridge of 30 feet, with abutments 30 feet in height.

The timber from the 160th station to the 540th, is generally mixed, being tamarac, spruce, hemlock, white and red pine, cedar, balsam, with poplar and alders.

The surface is, in places broken and rocky, with some level reaches of sand and boulders, sandy loam and swamps.

There are some pretty heavy cuttings and fillings on this section.

I here digress for a short space. While at this portion of the location, the Chief of the Nipissing Indians visited my camp and told me that the Indians were unwilling that any road or railway should traverse their Reserve, and informed me that there was a beautiful place up the Chippewa River for a railroad, and that having reached the head of the rapids, that a very flat country existed to the north of Taylor Hills, extending to the Smoke fall on the Sturgeon River, the base of which (Taylor Hills) we were now skirting. Knowing the difficulties that were ahead, having had to descend those hills in an exploration, some six years previous, I determined to have a trial of the Chippewa Valley, with my work still going on.

I explored up to the level country, and then thought that the ascent was much too great, but considering that without an instrumental test the Indians would report that I refused to take any notice of what they said.

I, therefore, had a line cut, up along the valley of the Chippewa, and levelled.

Part of the distance, some 80 chains, I found an ascent of one hundred and seventy (170) feet, and this was after I had lengthened the line in order to gain distance, but the actual rise of the river is about 200 feet in 80 chains, making $2\frac{1}{2}$ per 100.

From station 540 there is a gradual descent to station 796 (15th mile), where the surface is only 10 feet above Lake Nipissing; here an embankment of 20 feet will be necessary for about 8 chains, a number of small streams will have to be crossed in this latter reach, and the Duchesnay River, requiring a bridge of sixty feet span; also, there will be some deep but not very long fillings, with a number of cuttings mostly through sand and boulders and some rock.

The timber, white pine, cedar, hemlock, birch, tamarac, spruce, maple, &c., is abundant.

Solid and loose rock, sand and boulders principally form the surface.

Continuing onward, to the 995th station (19th mile) the line meets the base of the Taylor Hills. This last distance of some four miles has only one cutting of any moment averaging 15 feet deep for a distance of about 7 chains, and only three streams, including one of 20 feet wide, which will require abutments of 25 feet in height. Generally sand and boulders form the surface.

Forward from the 995th station, to the 1160th station (22nd mile), the location rises to the summit of the Taylor Hills, ascending diagonally to the height of 200 feet above Lake Nipissing (839 feet above the sea level).

The cuttings generally on this reach will be of rock, sand and boulders, and sand mostly hill side. At the summit a cutting of nearly 30 feet will be necessary for about 8 chains through sand and boulders, with indications of underlying rock.

The timber generally is hemlock, balsam, pine, birch, cedar and basswood.

The 1167th station reaches a swampy flat, with some small breaks of sand and boulder ridges, which extend to the 1300th station ($24\frac{5}{8}$ miles). Some small structures, one of 20 feet span, will be required over the meadow brook on this reach.

### LITTLE STURGEON RIVER VALLEY.

From the 1300th station, the location passes over rather an uneven country to the 1450th station (27½ miles) where the highest elevation of the line is attained, being 220 feet above Lake Nipissing (859 feet above the sea). This portion of the line runs across the immediate valley of Little Sturgeon River, the river itself being crossed by a bridge of one hundred feet span with abutments of twenty-five feet in height.

There will be a number of rock cuttings of no great moment and some pretty deep but short fillings, the greatest being 20 feet in height by 10 chains in length. Cuttings of rock, sand, sand and boulders.

### IMPROVEMENT OF LINE.

From the 1350th station, the line might be improved and shortened by a-half mile; this may be effected by keeping more to the west and avoiding a sharp turn to the north, but of necessity the cutting will be changed, and the embankment made much greater.

### SMOKE RIVER VALLEY.

From the 1450th station to the 1710th station (32⅓ miles), the location generally follows the valley of the Smoke River. The lead of the country compelling this which, however, increases the distance, and causes a divergence of a-half mile to the northward, a more direct route was tried, but it failed in grades.

A loop line was run from station 1484 + 97 to 1832 + 86 of the main line, being over a-half mile shorter than the main line, but hardly offering as good grades.

Along the valley of the Smoke River, the grades are all descending westward.

The river itself has to be crossed in three places; two structures of 60 feet span, and one of 40 feet will be required, also a divergence of the river to some extent will be necessary.

Some few rock cuttings on this section, and considerable fillings on account of the rise of the Smoke River.

The timber is mostly burnt off this section, some spruce, balsam and alders only remaining. Some rock, light loam and swampy ground form the surface.

### APPROACHING THE STURGEON RIVER.

The location at the last crossing of the Smoke River is upwards of 4,000 feet to the north-east of the Sturgeon at the great Elbow. From station 1710 onward there is a gradual running towards the Sturgeon River, on account of the hills to the northward and at station 1877 (36⅜ miles), the location has reached near its banks, being only 400 feet from the river.

The surface is generally level, but for a mile in the first portion of this reach it is much broken by gullies. Sand and clay exist with some rock on surface.

The timber generally is pine and balsam, with some brulé.

Near the Sturgeon River, from station 1877, the location follows the direction of the Sturgeon River towards its source to the 2270th station (43rd mile), and now and then touching its banks, going through a pretty level section, the surface of which is composed of sand and boulders, sand, clay and sandy loam, with a portion of rock.

River crossing—At the 2234th station the Otanacamigosi River has to be crossed by a bridge of two spans of 80 feet each, the abutments and pier to be 18 feet high. Pine, spruce, tamarac, cedar, birch and balsam, with alders are on this reach.

The Sturgeon River is left at station 2270, and crossing the Odell River at 2276th station by a bridge of 80 feet span, with abutments of 22 feet in height, then the location rises to a flat of country about 50 feet higher than the last reach, where a heavy bank is required.

Thence generally through a level country to the 2640th station (50th mile), the location near the centre of this reach is 80 chains from the Sturgeon River, and at its termination approaches within five hundred feet of it.

### SURFACE AND TIMBER.

This fine reach of seven miles has but little rock upon it, all of which can be avoided; the general soil is sand and boulders, clay, sand and sandy loam. A number of streams are crossed of no great size, which, with the rest on the location, I have put in tabulated form for convenience.

The timber consists of pine, tamarac, spruce, balsam, birch, cedar; maple and ash abound, some in brulé also.

### TAMAGAMING VALLEY AND RIVER.

From the 2650th station (55½th mile) the line passes over a deep gully at 2670th station, through which the Snake Brook flows before it reaches the high land to the left of the Tamagaming River, which river is approached by a descent of some 30 feet in 60 chains, and to be crossed by a bridge of two bays of 60 feet, the roadway of which bridge will be thirty feet above the low-water surface; here, for about twenty-five chains, a filling will be required averaging about 15 feet in height.

Thence rising in 33 chains 30 feet to a high table-land to station 2860, then descending over a broken tract to station 2930.

Crossing Black Water Brook at 2901st station, where a filling 30 feet in depth and 7 chains in length has to be made; also a number of cuttings, taken together, average about 15 feet in depth for 45 chains.

Surface.—On this reach, for the most part, sand and boulders are apparent, with perhaps some rock underlying, sandy loam also forms a large portion of the surface; with but little swamp and not a large quantity of rock.

The timber is pine, birch, spruce, cedar, balsam, ash, oak, with alders.

A divergence from near the 53rd mile might, on this last reach, be tried by keeping nearer the river, *i.e.*, to the left of the line, and again joining the present location at or near station 2930. By this means the steep descent from station 2860 to 2927 might be somewhat reduced and the cuttings and fillings altered for the better.

The Terminating Reach.—From station 2930 to 3310th station (62⅔ miles) the termination of the location mostly follows near the river, level and direct, not much cutting, being mostly embankment. The grades have to be kept up all along this reach on account of the spring freshets. Quite a number of short rocky points, some as through, and others as side cuttings, but none of any size. A number of streams also have to be crossed, two of which, Pebble Brook at station 2975, to be crossed by a bridge of 40 feet, and another, at station 3140, by a bridge of 25 feet.

Sand and boulders are principally on surface, with sand, sandy loam, clay, gravel, and some rock.

The timber is white and red pine, birch, spruce cedar, tamarac, ash, balsam, maple, with some young pitch pines; also a part of this reach is brulé.

The swamps along the line are not bad, as a general thing, but wherever any soft or deep deposits exist I have had them bored, as seen on section.

The Sturgeon River, from its source to Lake Nipissing, is about 130 miles long, rapid in many places, but yet fine reaches of smooth water exist. Its course is south-east, through a generally rough country, and yet offering facilities on its banks for the site of a railway.

It drains an area of some 2,300 square miles. Lake Tamagaming, lying about 30 miles to the east of the Sturgeon is its main source of supply, contains about 200 square miles, its discharge being a river of the same name 28 miles long, and joining the Sturgeon about 37 miles from its mouth.

The Maskinogi River, another branch, comes in from the west, 52 miles from Lake Nipissing, draining also a considerable extent of lakes.

About 115 miles up, the main Sturgeon is divided into two branches, inconsiderable in size.

### SPRING FRESHETS.

The location along the river for nearly twenty miles is unavoidably in rather low ground, and on account of the spring freshets in some places the banks have to be raised, but not to any great extent; in many places along the river the high water line was observed and noted.

A portion of the natural dam of rock at the Smoke Fall on the Sturgeon River could be blasted away in low water, and a shallow about five hundred feet above the fall deepened, by which means the water in the spring would be run off more rapidly and consequently kept at a lower pitch.

The Taylor Hills—so named on the plan—are a spur of the Laurentides or Laurentian Range, entirely of the gneissoid character (a bastard granite) very hard and durable, and where heavy beds exist would be very lasting in structures, but very hard and difficult to dress. The same formation lies on both sides of the Sturgeon. In some places I have seen indications of iron, but no other minerals, with the exception of mica, were seen, and that very inferior.

This spur of hills, after leaving the Quebec side of the river at Mattawa, runs along the Mattawa River and both sides of Talon and Trout Lakes, and along the north shore of Lake Nipissing, crossing the Sturgeon River between the 10th and 14th mile from its mouth.

The character of all the rock met with on the location was the same.

### THE SOILS.

Those that can be available for agricultural purposes are confined to the shore of Lake Nipissing, to the north of the Taylor Hills and along the immediate banks of the Sturgeon River.

The principal part being sandy loam, *i.e.*, a mixture of fine sand and clay. Most of the level tract along the Sturgeon River is a fluviatile deposit of this, of which also the delta at the mouth of the Sturgeon River and its banks for two miles from its mouth are deposits.

The upper portion of the river, where the line has been located, is of the same nature, and appears to be annually increasing.

I saw some clearings to the north of the Taylor Hills, the soil appearing to be of the same nature.

Clay in some few places is on the surface, and in others a vegetable deposit covers it.

The swamps are not extensive, the subsoil sandy, andthe surface generally a vegetable deposit.

Along the shore of Nipissing there is a mixture of maple and black birch land, stony in some places, and with vegetable mould on the surface, which for a few years would yield fairly, but without composts will not hold out.

### THE TIMBER.

The importance of the timber along this line demands especial notice from its quantity, size and quality, and its existence in any particular locality generally designating the soil.

#### *Pinus Genus.*

First, and the most important and abundant, we get the white or Weymouth pine (Pinus Strobus), in some places very large and everywhere abundant along the line.

Again, the Norway or red pine (P. resinosa) much more sparingly scattered along the location, and in a few places abundant.

(P. niger.) The black spruce is abundant, the same tree from which the extract is taken, good and of fair size.

Hemlock (P. Canadensis) is also abundant, of very large size; mostly found near the lake, but some on the Sturgeon River also.

(Larix Americana.) The black larch tamarac, hack-matack, in Newfoundland known as juniper or Newfoundland oak ; in the Province of Quebec as red spruce, are of good size and abundant.

(P. Balsamea.) Fir or fir balsam, American silver fir, [from which the Canada balsam is procured, not very abundant.

(P. rigida.) Pitch or black pine, only seen at or near the end of the line, small.

Of the Betula family (B. lenta). Black birch, the most important, also known as cherry birch and mountain mahogany, very abundant and of large size.

(B. papyracea). White birch, the bark of which is used for canoes, a fair quantity and large.

(B. excelsa.) Yellow birch, only to be found in small quantities.

### *Of the Acer Family.*

The most frequently met is the (A. sacharinum) or sugar maple, in different localities along the line, of large dimensions.

(A. nigrum.) Bird's eye or black maple, used for furniture, not very abundant.

Also, (A. rubrum.) Soft maple, in large quantities on the river.

(A. striatum.) Striped maple or moose wood, also to be met with.

The black ash or water ash (Fraxinus sambucifolia), in small quantities along the Sturgeon River.

### *Poplar Tribe.*

(Populus candicans.) Balm of Gilead.

Also, (P. tremuloides.) Aspen tree, a fair quantity, some very large.

### *Cedars.*

(Thuja occidentalis.) White cedar, in large quantity.

A few white elms (Ulmus Americana) are also to be met with.

Some grey oak (Quercus Prinos) in a number of places.

Occasionally the bass wood, or linden tree, (Tilia Americana) is scattered along the line.

Also, the choke cherry, the black cherry, the wild cherry, the hazel or wild filbert, with a variety of ground fruits.

I have the honor to be, Sir,

Your obedient Servant,

W. A. AUSTIN, C.E., P.L.S.,

*Engineer-in-Charge.*

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### CANADIAN PACIFIC RAILWAY—DIVISION A, 1879—SURFACE OF LINE.

| Description. | Length in Miles. |
|---|---|
| Sand and boulders | 17·55 |
| Sandy loam | 14·42 |
| Swamp, sandy | 10·03 |
| Swamp, vegetable deposit | 6·26 |
| Rock, solid | 5·64 |
| Loose rock | 3·76 |
| Clay | 3·15 |
| Gravel | 1·88 |
| Total | 62·69 |

### TIMBER ALONG LINE SURVEYED.

| Description. | Per Centage. |
|---|---|
| White Pine | 22· |
| Spruce | 15· |
| Cedar | 9·50 |
| Tamarac | 9· |
| Black Birch | 7· |
| Hemlock | 6· |
| White Birch | 5· |
| Balsam | 5· |
| Brnlè | 5· |
| Soft Maple | 4· |
| Sugar Maple | 3· |
| Poplar | 3· |
| Red Pine | 2· |
| Alders | 2· |
| Ash | 1· |
| Elm | 0·50 |
| Oak | 0·50 |
| Grass | 0·50 |
| Total | 100·00 |

## *Report on Exploration during Winter of* 1879 *and* 1880, *by Mr. Alfred Brunel, jun.*

OTTAWA, 14th February, 1880.

SANDFORD FLEMING, Esq., C.M.G.,
Engineer-in-Chief.

DEAR SIR,—Acting on your instructions of 12th November, 1879, I proceeded to Collingwood on the 13th, where I purchased supplies and dog teams, and engaged men for the trip, which I concluded would last about two months.

I found that the first available steamer would not leave Collingwood before Wednesday, the 19th of November, by which time the party was ready to start; meanwhile I received your letter of instructions.

In consequence of a heavy snow storm and very heavy weather, the steamer did not leave Collingwood until Friday the 21st., reaching Killarney on Monday the 24th., after having to lie to in a bay near the entrance to Lake Huron for about 30 hours from stress of weather.

I pitched my first camp in rear of the Village of Killarney, and made enquiries of the residents as to the best means of reaching the point where my exploration was to begin, the junction of the Spanish and Vermilion Rivers.

I found considerable diversity of opinion as to which route to take, there being only two ways of getting to the rear of the mountain range back of Killarney; either by Collins' Inlet or by the Whitefish River. I chose the Whitefish River, a stream about one hundred feet wide at its mouth, which drains the chain of lakes leading up to Whitefish Lake, and empties into the Georgian Bay, about half way between Killarney and Little Current.

I left Killarney with my party in a fishing boat on the 26th., at noon, and got to within four miles of the mouth of the river at dark, when we were brought up suddenly by running upon a rock, and as we could not see the channel, which was rather intricate, I concluded to camp at the first good spot on the shore.

The next day, Thursday 27th., it rained hard all day, and we were forced to remain in camp. On Friday we started again for the mouth of the river, but had only proceeded about a mile when we were stopped by ice which had formed during the night, and we were obliged to break our way to the shore of an island which presented the only good camping ground in the neighborhood where I was forced to remain until the ice got strong enough to bear.

On Monday, December 1st, I broke up camp, and moved to the mouth of White Fish River, which we reached without accident, though not without some danger, the ice being very thin. The next day, the ice being stronger, we moved over the balance of the provisions.

I found the river open and the small lakes partially frozen, which caused a delay of some days.

I reached Ahmic Lake on the 8th December, and on the 9th I left the camp in charge of an assistant with instructions to move up to the east end of Lac Penage without delay, and with Mr. Quin and three packers, I started across country to the Vermilion River, which we reached on the 11th at noon, just above the junction with the Spanish River. The Vermilion being about three hundred feet wide at this point.

I followed the south bank of the Vermilion River, which was steep in places, but with more or less of flats at the base of the hills for about a mile, when the river suddenly narrowed to a hundred feet, and the banks became steep and rocky for a quarter of a mile, in which distance there is a fall in the river of about twenty feet.

At one and a half miles from the junction the river widens out again to three hundred feet, and the flats on the south side stretch back for some distance from the river; the banks ranging from eight to ten feet above the water, which was pretty high on account of the late rains.

At three and a half miles above the junction I reached the first lake, which is about half a mile long and two thousand feet wide, there being a continuous flat from near the falls up to the east end of the lake, four miles from the junction.

Up to this point the line would be very good, and all in earthwork, excepting about half a mile passing the falls, which would be side hill rock, but not heavy.

From the fourth mile I followed along the river, which is almost a continuous rapid, falling twenty feet in three fourths of a mile, with portions of the side hill pretty steep and rocky.

At the fifth mile I entered on the second lake, the south shore of which takes a sharp bend to the south at the outlet, necessitating a rather heavy cut in getting over the brow of the ridge after leaving the river.

Between the fifth and eighth miles along the south shore of Lake No. 2, I found the country very rough and rocky being a good deal broken and indented with bays, though with moderately heavy work I do not anticipate any difficulty in getting a good line

From the eighth mile to the eleventh mile the country is very good, being either easy side hill or level flat with no rock of any consequence.

At the eleventh mile there is a fall in the river of about forty-five feet, just above which I think it would be best to cross over to the north side of the river, it being possible to get a good line on the north side up to the thirteenth mile, and then return to the south side again, requiring two bridges of about one hundred and fifty feet span each.

By crossing to the north side of the river, the line between these points would be shortened and at least one bridge avoided.

The river takes a sudden bend to the south about half a mile above the falls, and being divided into two channels with a big bay to get round, would make necessary very sharp curvature or two bridges. Another large stream falls into the Vermilion from the south, a mile further on.

Whichever side is adopted here, the line will be somewhat rough and rocky, and will require the maximum curvature in several places.

Between the eleventh and the fifteenth miles the river falls about twenty-five feet, and the last two miles are a good deal burnt.

From the fifteenth to near the twenty-first mile, the line would run through a stretch of burnt country some distance south of the river, cutting off a big bend.

The work would not be heavy, the ridges showing surface indications of being composed of clay.

This part of the line would rise to between seventy and eighty feet above the river level, but the curvature would be easy.

Near the twenty-first mile, the line crosses the river which is 200 feet wide, and after traversing an easy stretch of country for about one mile, recrosses the river at a point where it is about four hundred feet wide, but dead water, being in fact a continuation of Rat Lake, which lies to the south.

At about the twenty-second mile, I left the river and followed up a small stream, coming in from the east, for about one mile ending in a small lake. This mile would be swampy, but could be drained easily, being separated from the waters running into Round Lake by a low narrow ridge of rock, and a drop of about twenty-five feet into another lake one and a half miles in length by a mile in width.

For the first quarter of a mile the north shore of this lake is rocky, but the work would not be heavy, after which the line traverses a good stretch of flat burnt country, gradually rising back from the shore of the lake to the east end, near the twenty-fourth mile, where the stream forming the outlet of the lake begins.

This stream is about one hundred feet wide, with very little current, and enters Round Lake at its western extremity; the banks are from ten to twenty feet in height, with considerable width of valley on each side, apparently consisting of first-rate land.

The line follows this stream up to the twenty-sixth mile, over very even counry, when it bends to the north-east, and following along the shore of Round Lake, levation 785 feet above the sea, leaves it at the twenty-ninth mile.

The last two miles would be altogether on side hill, with one stream to cross of about fifty feet in width, the side hills consisting mainly of rock.

Leaving Round Lake at the twenty-ninth mile, the line rises eastward along a hardwood ridge, separating Round Lake and Long Lake. (Elevation of latter 794 feet above the sea,) reaching the summit, which is ninety feet above Round Lake, at the thirtieth mile.

The ridge is very narrow at this point, and drops away suddenly on both sides, so that though the cut would be from thirty to forty feet in depth, at deepest point, it would only extend over about two hundred feet at that depth.

From the thirtieth mile to the thirty-sixth mile the line would follow the shore of Long Lake on the north side, although there are several rough places to be encountered, the line is generally good, the slopes of the hills being easy and shore regular, and although the general appearance of the country is rocky, probably half of this distance would be in earth-work.

At the thirty-fifth mile there is a high bluff jutting out into the lake, but which falls away to the rear. The angles getting round the front of it are very sharp, and I think it would be necessary to rise over the low portion of the ridge in the rear, which would necessitate a rather heavy rock cut.

From the thirty-fifth mile to the fortieth mile the line gradually improves, there being less rock than on the last five miles, and no heavy cuts. There is a rise in the water level here of about three feet, with a short stream between the lakes.

From the fortieth to the forty-fourth mile the line would traverse a level flat, which borders the lake on the north side, rising ten to twenty feet above the level of the lakes.

From the forty-fourth mile to the forty-sixth mile the line would be altogether in light rock work along an easy side hill.

At the forty-sixth mile the line reaches the summit or watershed between the waters of Whitefish River and Wahnapitae River. The summit here is very low, rising only about twenty feet on the portage, which is a quarter of a mile in length, above the water flowing west, but the rocks on the south of the portage rise perpendicular to the height of a hundred feet.

After crossing the portage the water level drops about forty feet, traversing a small lake, (Elevation 757 feet above the level of the sea,) for half a mile east, then a quarter of a mile of small stream, into a lake lying north and south, and about one and a half miles in length. From the south end of this lake a stream flows into the Wahnapitae River. Elevation 754 feet above the sea.

From the forty-sixth mile the line would keep near to the level of the dividing ridge, and along the side hill past the head of the last lake and enter a hardwood valley, bounded by high rocks on both sides, and after crossing a clay ridge at the head of the valley, about the forty-eighth mile, would get into a level piece of burnt country almost surrounded by hills, with a small stream running through it, in a north-easterly direction, and falling into the Wahnapitae River, at the forty-ninth mile, just below the falls. Elevation 757 feet above the sea.

These falls consist of several leaps varying in height, and about forty feet in all, stretching over a third of a mile of river, the banks being rough on both sides and composed entirely of rock. Elevation of river at head of the falls, 800 feet above the sea.

From the forty-sixth to the forty-seventh mile the line would be on side-hill more or less rocky, but from the forty-seventh mile to the forty-ninth mile, where it strikes the River Wahnapitae the line would be altogether in earth and very light.

From the forty-ninth mile the line would follow the west side of the river, along the rocky side-hill for a third of a mile, and then would enter on a flat about ten feet above the river, crossing it at about the fiftieth mile.

From the fiftieth mile to the fifty-fourth mile, the line would traverse the level lands, which run back some distance to the foot of the hills, the banks of the river rise from ten feet, at the fiftieth mile, up to about fifty feet at the fifty-fourth mile. The river winds a good deal, but the base of the hills is pretty regular, so that a reasonably straight line can be obtained on the low ground between the hills and the river, with no rock.

From the fifty-fourth to the fifty-eighth mile, the line would be nearly altogether on side hill of an easy nature, and mostly clay, there being only about one mile of rock. Between these points, the river rises thirty feet.

The line would leave the Wahnapitae River, (Elevation 830 feet above the sea,) at the fifty-eighth mile, and follow a small stream up to its source at about the sixtieth mile, where the stream is lost amongst small ridges and swamps, crossing which at an elevation of fifty feet above the river, or about 880 feet above the sea level, would drop down about thirty feet at the sixtieth mile or to an elevation of 850 feet above the sea and running along the edge of a beaver meadow and alder swamp for a short distance, enter a large, burnt tamarac swamp stretching off to the north-east, up to the sixty-fourth mile. Here the swamp ends in a beaver lake, with a small stream running out to the north, and high hills to the north-east.

A valley stretches off to the eastward from this lake, which the line would have to ascend, reaching the summit in about one mile, at an elevation of 940 feet above sea level.

From the sixty-second mile, the tamarac swamp is bounded on the south by ridges of rock from eighty to one hundred and fifty feet in height. The grade beginning to rise, at about the sixty-third mile, onto the side hill, would reach the summit at the sixty-fifth mile without much heavy work, though it would be altogether in rock.

From the sixty-fifth mile, the line would skirt a beaver meadow and lake for a mile and a-half, and after crossing a low ridge, would follow a side hill bordering a second beaver lake of about the same level as the last, up to the sixty-eighth mile, about one-half of this distance would be in rock, the rest constructed from side ditches.

At the sixty-eighth mile, the line begins to descend in a northerly direction, hugging the side hill for about three quarters of a mile, then drops onto a low ridge running north and south. After following this ridge for half-a-mile in a north-easterly direction, the line turns east and gradually descends for half-a-mile along the north side of the hills bordering a long narrow lake, out of which flows a stream 30 feet wide, in an easterly direction. The line follows this stream, still keeping on the side hill, for about one mile, when the stream, taking a sharp bend to the south, the line would cross it at about the seventieth mile. These two miles would be mostly all rock. The level of the stream at the crossing would be about 810 feet above sea level, or a fall of one hundred and thirty feet from the summit.

After crossing the stream the valley widens out to a quarter of a mile; the line following the north bank, the first portion of which is low and swampy, making it necessary to hug the rocky side hill, but after the first mile the banks rise to ten and fifteen feet above water, the valley becomes more open and the hills recede.

There is no difficult work on this portion of the line, being all light earthwork, excepting two or three small side hill rock cuts at points where the river runs close to the rocky bluffs.

The soil is mostly clay loam, and has been burnt over, being now covered, to a great extent, with small cypress bushes.

The stream changes its direction in several places, but the valley widening out a good deal enables the line to be maintained in its general direction of north 70° east, up to the crossing of the Sturgeon River, near the seventy-sixth mile, which would be about a quarter of a mile from the end of Mr. Austin's Trial Location of last summer, station 3,310 + 51. Elevation of Sturgeon River at this point, 790 feet above the sea.

The connection with Mr. Austin's line would be very good.

### GRADES.

As a general thing, the grades would be light, as there is no sudden rise or fall in the general level of the country.

The maximum gradients of one per hundred would be confined to the following points on the line, viz :—

1. Between the fourth and eighth miles on the rocky shore of lake, which would probably require several pieces of maximum grade to get over the spurs jutting out into the lake, say one mile each way.
2. Between the eleventh and the thirteenth miles, about one mile each way.
3. Between the fifteenth and twentieth miles, two miles each way, there being two low summits to get over in that distance, of from seventy to eighty feet above the river.
4. Between the twenty-ninth and thirty-first miles, one mile each way, rising over the ridge between Round Lake and Long Lake.
5. Between the thirty-sixth and thirty-eighth miles, where a high spur juts out into Long Lake, with a sharp angle at each side, one mile each way.
6. Between the sixty-third and sixty-fifth miles, rising to the summit, between the Wahnapitae River and the Sturgeon River, two miles rising east.
7. Between the sixty-eight and seventieth miles, getting down from the summit to the Sturgeon River, two miles falling east.

### BRIDGING.

The bridging on the line explored would be very light, consisting of crossings of streams at the following points, viz.:

At the eleventh mile, one span of one hundred and fifty feet. Thirteenth mile one span of one hundred and fifty feet. Twenty-first mile, one span of one hundred and fifty feet and two spans of seventy-five feet each. Twenty-second mile, one span of one hundred and fifty feet, and two spans of seventy-five feet each. Twenty-seventh mile, one span of one hundred feet. Fiftieth mile, one span of one hundred and fifty feet and two spans of seventy-five feet each. Seventieth mile, one span of fifty feet and at the seventy-sixth mile, one span of a hundred and fifty feet and two spans of seventy-five feet each, over Sturgeon River.

There are also a few crossings of small streams, which can be spanned by beam culverts of from ten to twenty feet opening, besides the usual number of smaller structures required.

### BALLASTING.

I found good indications for ballast pits, in several places well situated, as regards the line, but the ground being hard frozen, with several inches of ice on it, in most places I could not ascertain by digging.

### TIMBER.

The country traversed, is well suppled with timber of the best quality for ties and bridging, within a reasonable distance from the line, consisting of White and Red Pine, Hemlock, Birch, etc.

### ROCK.

The rock varies from a hard black slate, on the western portion of the line, to a Gneissoid or Granite rock, on the eastern portion, but the work being principally on the side hills and the rock more or less disintegrated by the weather, it would be easily worked.

### ALTERNATIVE LINE.

On reaching the Wahnapitae River I instructed Mr. Quin to explore easterly for a line to the Veuve River, in case we should not be able to get across to the Sturgeon River on the line my instructions indicated.

Mr. Quin separated from the rest of the party, on the 31st December, at the fiftieth mile, taking three men and a dog team, and ascended a small stream coming in from the East.

On the following Sunday his dog team came into camp at the fifty-eighth mile, with a request for a fortnight's supply of provisions, to take them through to Lake Nipissing.

In the meantime I had ascertained that it was possible to get a fair line according to my instructions, so I sent back word to Mr. Quin to rejoin the main camp, which he did on the next day, January 5th.

He reported that he was unsuccessful in finding the Veuve River, which he thought was wrongly placed on the map, but from the general character of the country examined by him, I have no doubt a line could be got through to that stream from the Wahnapitae River, and as that was the only doubtful point in connection with a line by the Veuve River I am led to believe that a satisfactory line can be had in that direction.

I have endeavored to show, on the accompanying map, the position of the proposed line as far as explored by me, but the smallness of the scale prevents the topography of the country being shown as well as could be wished.

I reached the terminus of Mr. Austin's line on Tuesday, the 13th January, Nipissing on Saturday, the 17th, and Rosseau on the 20th, from which place, after paying off the men, I returned to Ottawa on the 24th January.

I have the honor to remain,
Your obedient servant,

**A. BRUNEL, JUNR.**

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## *Report on Exploration during* 1871, *by Mr. William Murdoch.*

OTTAWA, February 9th, 1872.

SIR,—According to your instructions at Ottawa, June 22nd, 1871, I proceeded to the Sault Ste. Marie and commenced a survey, on the American side, of the canal and shore line of the south side of Lake Superior, establishing points of triangulation, tying them in with a base line, running due east and west astronomic, on the Saint Mary's Island; also traverse of the shores on the Canadian side, making my westerly triangulation line the proposed location for a bridge, and took soundings on it every twenty-five feet, and found the bottom to be in all cases sandstone rock, and the result is shown on the profile.

I then continued my line easterly on the flats of the St. Mary's River, passing through a portion of the rear of Saint Mary's village, immediately under the ridge of clay bluffs for four miles, then continuing on the flats of the river to the crossing of Root River, which will involve a span of 100 feet on sandy soil with 1,200 feet of a bank including both sides 15 feet high.

Thence on to Garden River where a span of 120 feet will be required (foundations clay bottom), and an approach of bank on east side of 250 feet long, 10 feet high; thence on to Echo River, where a span of 150 feet would be sufficient on clay foundations. Up to this point it would be merely bank from side ditches through light sand and gravel, almost on a level from Sault Ste. Marie, slightly timbered with second growth of pine, poplar, balsam and small birch, a distance of 18½ miles. Then onward for one mile a continuation of the same work, the next mile being a side-hill cut full of loose boulders and sand; thence for six miles of prairie land, sand and clay subsoil, to the flats of Bar River, where we get on an easy grade to the crossings of it. Here I may mention that there are 15,000 acres (about) of meadow land fit for grazing purposes, and thinly timbered in clumps. The crossings of Bar River, three in number, will require 50-feet spans on rock foundation, 15 feet above the ordinary low water level. Here some side hill cut and fill of rock is required, 500 cub. yards of rock in all, the rest from borrow ground. At one mile further on of level ground we begin to rise to the height of land on a grade of about 1·12 per 100 for two miles. By keeping the line a little to the north the work could be made easier than present profile, and would be principally loose rock, with plenty of borrow ground of sand where material could be obtained. On from this point for 2,000 feet a bank averaging 10 feet high, rising 1 per 100, brings us to the height of land at station 1653, where a rock cut of 2,000 feet in length and 20 feet deep is necessary, then descending on the other side for three miles in the valley of a small stream of sandy bottom, then the line will be on an easy side hill with a bank of 10 feet for a mile rising 1 per 100 to station 1,900, where a rock cut of 1,200 feet long, 20 feet deep will be required. Thence on to Desert Lake with easy grade and work where for one and a half miles along the shores of the lake there will be side hill cut and fill, principally rock and middling heavy work. On leaving the shores of Desert Lake, we rise on easy grade to a table land of clay till we reach the Thessalon River, a distance of 5½ miles, and partly along the shores of Ottertail Lake. Nearly all the work will be bank from side ditches, with 4 or 5 cuts averaging 5 feet deep for about 4,000 feet in all. At the Thessalon River a bridge of 100 feet span will be sufficient (foundations clay). It would be here necessary to lower the river by making a cut at the falls, which are two miles below this point, this can be easily done, only involving 300 feet of rock, cut 6 feet of an opening 6 feet deep, which would lower the river at least 5 feet, and drain all the adjacent lands which are covered in the spring of the year with 4 or 5 feet of water. On crossing the river we have wet beaver meadow (clay bottom) for two miles to station 2440. Here, by present profile, there is a cut 3,000 feet long, 25 feet deep, rising 1 per 100 on a curve, which is composed of loose boulders and gravel on top with probably rock bottom.

This cut, I think, can be avoided by keeping the line further south near the Thessalon River, and reaching the same elevation on an easy grade in about 4 miles, joining the same line at about station 2,650, making the line more direct and with less curvature.

Thence for 12 miles over sandy soil with no grades of any consequence, almost level, the work will be bank from side ditches, with small mixed timber and some large pine. Then for 2 miles the work will be heavier, being sand stone cuts in places, and at station 3360 a cut of 25 feet deep and 1,000 feet long has to be taken out of sand rock. Thence for a distance of 6½ miles through sandy soil and loose boulders to station 3710, there is moderately easy work and easy grades. Here a cut averaging 15 feet deep and 2,000 feet long, composed of sand and boulders, has to be taken out. This cut might be avoided by lengthening the line a little. We now reach the valley of the Mississaga River, a flat sandy plain for 2 miles to the crossing of the river.

The bank on the west side is 20 feet above the ordinary level of the water and all sand; on the east side the bank is rock and 25 feet above the water, requiring a bridge of 200 feet span. Then for ¾ of mile further on, on level ground, is the River Obatitgosing, it will require a span of 75 feet. Then the ground extending for 13 miles is perfectly level; in places an open sandy plain, thinly timbered with scattering pine and balsam, on which distance the work would be bank from side-ditches.

This now brings me to the crossing of Blind River, where a span of 100 feet would do, with rock foundations on either side. On the east side an average cut of 5 feet for 1,500 feet would be necessary, rising 1 per 100; and the same amount of cut for the same distance, getting into the valley of Blind River—which we gradually leave, getting 5 miles of ash and cedar swamp, with good bottom, almost level to Station 4,852. Then from there to the end of the first 100 miles of instrumental work, we go over rocky ground, composed of loose boulders and sand, easy grades all the way; this portion is timbered with small oak, maple, birch and scrubby pine, and this last portion of the line is, in places, touching Lake Huron.

All the rivers mentioned rise from 4 to 5 feet in the spring; and many of them are dammed back by saw-mills, causing much flooding in the spring and fall of the year.

On commencing my reconnoissance of the country where my instrumental survey terminated at Station 5,296, I explored eastward on a level plateau, at an elevation about 50 feet above Lake Huron, for a distance of five miles a portion is flat, bare rock, covered in places with moss, when I came to a small creek running parallel to the shore and got down on it on an easy grade to the Lake, crossing at the junction of another stream, where a 50 feet span is necessary,—rock on both sides. At this point the line would have to be built along the banks of the shore, partly in the water, for upwards of a mile or more, the most of the distance on a shallow, sandy beach. Some of the small bays will be 4 feet deep. This brings me to the natural flats of the valley of Serpent River, passing close to Mr. Walsh's steam saw-mills, where tugs and vessels load lumber. Thence following the valley on the west side of Serpent River, for a distance of 6½ miles, almost perfectly level, with clay soil and burnt cedar, and pine. At this point we cross the river, where a bridge of 100 feet span would be sufficient, with, I think, rock bottom at no great depth, for foundation. Up to this point the country is burnt and unfit for settlement. Onwards, ½ mile from here on the east side of the river and parallel to it, we come to the height to be surmounted between Serpent and Spanish Rivers; this is a rock bluff with a natural depression in it of about 45 feet, which requires a cut of 20 feet for 300 feet, with a bank approach from the south, involving a bank of 10 feet average for 3,000 feet. This will bring us on an easy flat leading to Spanish River, a distance of 2 miles, where a natural valley commences, running parallel to Spanish Bay and River, perfectly level on clay soil, principally covered with burnt windfall, for some miles, and for long distances, open tamarac, burnt land averaging from ½ to 1 mile in width. At this point, 18 miles from the shore of Lake Huron, we cross the Spanish River where McGee's Creek comes in on the east side. The banks are about 15 feet high, composed of sand, and the river at this place is 300 feet wide and 12 feet deep. Thence we follow the flats of McGee's Creek, for a distance of 18 miles, on the south side, having to cross it about 2 miles from the mouth with a 40 foot span.

We rise this distance on an easy grade past four rapids, making in all about 60 feet Then we get into open plains for about three miles, then follow flat tamarac swamp through a natural valley to a point one mile north of Long Lake, continuing on parallel to the lake till we reach the lake called White Fish Holme. Thence in a south-easterly direction till we come to what is called the 5th Portage on Long Lake crossing a small creek. Thence running easterly along the bank of stream for one mile, we cross the connecting waters of Long Lake requiring a 50 foot span bridge. Thence running easterly to Lake Number Two, between Lakes One and Two there is a small height of land 15 feet high, which only requires a cut of 10 feet deep, 30 feet long of rock.

I then passed on the south shores of Lakes Nos, 3, 4, 5, 6 and 7 as shown on my sketch plan running due east; or the line may be taken north of Lakes 5, 6 and 7 in a natural valley, through which a line can be built with no heavy work, being partly side hill cut and fill of clay, sand and some small knolls of rock 12 feet high with good level valleys between the lakes, a distance of five or six miles. Then from this point we went due east, on dry level meadows for about four miles. Thence along the south side of Lake Number 14 and crossing between 15 and 16 in a natural level valley, the direction of which is shown on my sketch plan through tamarac, cedar and balsam up to Lake Number 18, a distance of about six miles further. At this point the land becomes broken with small clay hills, here we cross a small stream between two lakes, and on the east side of Lake Number 18 the granite begins, and we rise about 40 feet in a quarter of a mile when we reach a level plateau of a mile crossing a lumberman's road. This is the height of land between Lac Penage and the waters running directly south to Lake Huron and eastward into the Wahnapatae River. When we begin descending to Lake Number 20, on an easy grade, only a small ridge bone of rock separates the level lands from the valleys which we follow for one mile at Lake 20. The line will cross it as it is shallow, with clay bottom and it is raised four feet by a beaver dam. Then we take the natural portage between Lakes 20 and 21 due east, which is a valley between them being broken by a clay ridge with probably rock below, 40 feet high and 300 feet across, about the same level on both sides. This valley leads in a direct line to Lake Number 21, which is the head waters of the east branch of the Mate-ze-na-zing River which empties into Lake Huron at Collin's Inlet. The line will follow the north and east side of Lake 21, which is side hill and flat in places to the valley of a creek coming from Lake 22. Thence on clay soil for a mile to a low granite ridge running north and south; a cut of 15 feet deep and 600 feet long will have to be taken out, and the line will pass on the south side of Lake 22. We then meet a natural valley bearing E.N.E. for three miles quite level to a small pond, the source of what is called Swamp Creek, with wide, level valley, and opening into extensive clay flats as it nears the Wahnapitae River. From Lake 21 to here the country is all burnt over and timber of all kinds destroyed, but the soil is strong clay, the vegetable mould being all burnt off the top, and the fall imperceptible the whole distance. The crossing of the Wahnapitae River will be about 200 feet wide, on clay sub-soil. We then continue south-east on the natural flats of the river for four or five miles to the crossing of a creek 50 feet wide, level banks ten feet above the water. Thence east, rising easily to the height of land, soil clay, probably 12 feet deep, where there will be a cut 800 feet long, 12 to 15 feet deep. We then enter a good valley running south-east for a mile; thence east two miles to lake, No. 23, at the entrance of which there will be an easy side hill cut and fill, of granite, 300 feet long. Thence across a shallow bay, 500 feet; then on the west shore of the lake we have to make an unavoidable crossing, to an island, 500 feet across and 30 feet deep. Thence to Island No. 2 there is a small channel 30 feet wide; then, with a bank for 1,000 feet ten feet high, we get into a natural valley running due east for one and a half miles. Thence south-east ½ mile to a low bluff of rock, which, with a low bank approach rising about 0.50 per 100, will give a cut of ten feet for 300 feet long, which brings us to the summit, and then begins falling easily for one mile. Thence south-east, curving round three small lakes on ordinary ground and work, till we reach a valley bearing S.S.E., clay bottom, between granite bluffs 40 feet high, running almost in a straight line for a distance of ten miles, varying from 500 to 600 feet wide, and thinly timbered with burnt dead tamarac, in many places open altogether. Thence running S.E. to the first crossing of French River on almost level ground, we come to the main channel, which is 600 feet across, 30 feet deep in the channel for 300 feet, and open all the year round with strong current; rock on both sides; meeting the same depression or valley on the other side, continuing to the middle branch of French River straight for a mile, which only involves a crossing of 60 feet in about two feet of water, passing through in a small rapid. The banks are about 25 feet high requiring abutments of 15 feet high on rock foundations; here the valley is broken and will require about 15,000 cubic yards of fill with a side hill cut of clay for half a mile on a rise of 1 per 100, which brings us to a level plateau of splendid land where we run almost due east for 2½ miles, we come to the Horse Rapids or last crossing of French River, which will require a crossing of 100 feet rock foundation on both sides about 25 feet above the usual low water level. Thence for a mile the land is slightly broken with rocky knolls but level around them. Thence we have level lands for two miles till we reach the crossing of Pickerel River, bearing E.S.E. Thence S.E. for some miles there are extensive flats fit for settlement, clay loam, timbered with white oak, rock elm, maple, birch, basswood, ironwood, hemlock and cedar.

The crossing of the Pickerel River will be about 100 feet wide, sandy bottom and shallow clay on each side.

This point will be suitable for the junction of the various projected lines coming from Ontario and Quebec, having all the advantages of soil and timber, being plateau of good land.

I am, Sir,
Your obedient servant,
(Signed) WILLIAM MURDOCH,
*Engineer in charge of Division W.*

SANDFORD FLEMING, Esq.,
Engineer-in-Chief, C.P.R.

d lines coming
, being plateau

DOCH,
*Division W.*

# APPENDIX 19.

## REPORT ON THE CLASS OF LOCOMOTIVE ENGINE PROPOSED TO BE ADOPTED, AS A STANDARD, ON THE CANADIAN PACIFIC RAILWAY, BY MR. CHARLES BLACKWELL.

CANADIAN PACIFIC RAILWAY OFFICE,
OTTAWA, 5th July, 1879.

SIR,—According to your instructions I have made a careful examination of the working of several of the leading railways in the United States and Canada, with a view to the establishment of standard types of rolling stock for adoption on the Canadian Pacific Railway,—and herewith beg to lay before you the result of my investigations.

I am of opinion, that to satisfactorily work the passenger and way-freight traffic of the Canadian Pacific Railway, there will be no necessity for having more than one class of engine.

When the traffic becomes fully developed, necessitating the movement of very heavy through freight trains, another type of engine, with greater tractive power, may, with advantage, be introduced.

But until then I would recommend the adoption of a standard type similar to "Class C" in use on the Pennsylvania Railway, and the standard passenger engine on that road. Its cylinders are 17 ins. by 24 ins., and the driving-wheels, four in number, 62 ins. in diameter, over the tyres, and 8 ft. 6 ins. from centre to centre.

In my selection, Mr. Tandy, the Mechanical Inspector, concurs, and a joint report upon the subject will be submitted by us, as soon as we can again meet and more fully discuss the matter.

Such an engine would be capable of doing the passenger, as well as the way-freight work of the road; and would, I consider, prove a more efficient engine for even through freight traffic, than locomotives having the same size cylinders and wheels, now running, and hauling the through freight, on the Grand Trunk Railway.

The number of loaded cars hauled by the Grand Trunk engines, varies according to the grades found on the various parts of the road, as follows:—

| | | | | | | |
|---|---|---|---|---|---|---|
| Between | Detroit and Port Huron, | 32 | cars. | Paying load, | 320 | tons. |
| " | Sarnia and Toronto, | 21 | " | " | 210 | " |
| " | Toronto and Belleville, | 19 | " | " | 190 | " |
| " | Belleville and Brockville, | 21 | " | " | 210 | " |
| " | Brockville and Montreal, | 27 | " | " | 270 | " |
| " | Montreal and Richmond, | 24 | " | " | 240 | " |
| " | Richmond and Island Pond, | 19 | " | " | 190 | " |
| " | Point Lévis and River du Loup, | 22 | " | " | 220 | " |

In Canada, and on many railways in the United States, passenger trains are run by engines having 68-inch driving-wheels; but experince on the Pennsylvania railway, where both 62 and 68-inch driving-wheels are used, points to the greater efficiency of the smaller wheeled engine.

In winter the larger wheeled engines are sooner crippled by snow than those having smaller wheels.

For passenger trains, making frequent stops, the smaller wheeled engine has a great advantage over the other, from its ability to attain its maximum speed in much less time, thus obviating the necessity for excessive speed of the latter, to make up the time lost in attaining the maximum speed of the former.

As regards speed obtained with 62-inch wheels, reference to the time-tables of the Pennsylvania Railway show as high an average speed, with heavier trains, as that attained on other roads, equipped with engines having 68-inch driving-wheels, or even larger,—and said to be effected, at no greater cost, than with larger wheels.

Should very fast through passenger or mail service be required, where few stops are to be made, an engine of precisely the same type, but with 68-inch wheels, would doubtless perform the work more economically and satisfactorily in summer; but in winter, for both fast and ordinary passenger traffic, as well as for freight, the smaller wheel would be most reliable.

The tractive power of such an engine as I have recommended, taking the boiler pressure at 140 pounds per square inch and the effective piston pressure, at four-fifths, or 112 pounds per square inch, is equal to 12,530 pounds.

Experience points to the conclusion, that to satisfactorily work heavy passenger traffic, especially in winter, a tractive power, equal to the above, is desirable.

The same power could be obtained by using a larger wheel in connection with a larger cylinder, but so far, 17-inch by 24-inch cylinders seem, in this country, to be the largest generally used for passenger traffic, although in England larger cylinders are successfully worked.

To give the same power, a 17-inch by 26-inch cylinder would require a 67-inch wheel, and with this sized wheel, a cylinder about 17¾-inch by 24-inch would also give a similar result.

I have no doubt but that engines of such dimensions will be built, and prove satisfactory; but the type I have recommended, having been long tried, its efficiency is placed beyond a doubt.

I am of opinion, that except for heavy *through* freight trains, on the full development of traffic, there is no reason why there should be more than one class of engine.

This would result in great economy in repairs; and the quantity of material required to be kept on hand for such repairs, could be reduced to a minimum.

By using ordinary box-cars, and loading them to the extent of 20,000 lbs. each, the class of engine recommended is capable of moving at a low speed, under favorable circumstances and on a straight line, approximately as follows:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| On a | grade of | 0·35 | per 100, | 48 | cars, | 480 | tons | paying load. |
| " | " | 0·40 | " | 43 | " | 430 | " | " |
| " | " | 0·50 | " | 37 | " | 370 | " | " |
| " | " | 0·60 | " | 32 | " | 320 | " | " |
| " | " | 0·70 | " | 28 | " | 280 | " | " |
| " | " | 0·80 | " | 26 | " | 260 | " | " |
| " | " | 0·90 | " | 22 | " | 220 | " | " |
| " | " | 1·00 | " | 21 | " | 210 | " | " |

Practice shows, that on a grade of 1·00 per 100, with 4° curves, the number of cars as above quoted, for that gradient, requires to be reduced to 19 or less, reducing the paying load to less than 190 tons; and on all grades where similar curves are introduced, the number of cars which can be drawn over the line, must be reduced in a corresponding manner.

Thus the advantages are apparent, of the light gradients, *equated for curvature*, which system you inform me is being carried out on long sections of the Pacific Railway, notably between Lake Superior and Manitoba. Here, according to the above, the paying load, per maximum train, will be 370 tons, as compared with 190 tons, on ordinary gradients of 1·00 per 100, with 4° curves.

By increasing, to a slight extent, the strength of the cars, and loading each with 30,000 lbs., the paying load, with its enlarged capacity of cars, would be approximately as follows:—

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| On a | grade of | 0·35 | per 100, | 38 | cars, | 570 | tons paying load. |
| " | " | 0·40 | " | 34 | " | 510 | " |
| | " | 0·50 | " | 29 | " | 435 | " |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| On a grade of | 0·60 | per 100, | 26 | cars, | 340 | tons paying load. |
| “ “ | 0·70 | “ | 22 | “ | 330 | “ |
| “ “ | 0·80 | “ | 20 | “ | 300 | “ |
| “ “ | 0·90 | “ | 18 | “ | 270 | “ |
| “ “ | 1·00 | “ | 16 | “ | 240 | “ |

When the through freight business of the road is fully established, it may then be advisable to adopt another type of engine for hauling it; and so far as my observations have extended, I consider that the “Consolidation” class of engine, having 8 wheels coupled, and a single pair of leading wheels, will be the most satisfactory.

This class of engine will, with 20 in. by 24 in. cylinders, and 50 in. wheels, haul at a low speed, under favorable circumstances, and on a straight line, approximately as follows (each car being loaded to the extent of 20,000 lbs.):

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| On a grade of | 0·35 | per 100, | 84 | cars, | 840 | tons | paying load. |
| “ “ | 0·40 | “ | 76 | “ | 760 | “ | “ |
| “ “ | 0·50 | “ | 65 | “ | 650 | “ | “ |
| “ “ | 0·60 | “ | 57 | “ | 570 | “ | “ |
| “ “ | 0·70 | “ | 50 | “ | 500 | “ | “ |
| “ “ | 0·80 | “ | 45 | “ | 450 | “ | “ |
| “ “ | 0·90 | “ | [illegible]9 | “ | 390 | “ | “ |
| “ “ | 1·00 | “ | 37 | “ | 370 | “ | “ |

By increasing the load per car to 30,000 lbs., the paying load would also be increased, and be approximately as follows:—

| | | | | | | |
|---|---|---|---|---|---|---|
| On a grade of | 0·35 | per 100, | 65 | cars, | 975 | tons paying load. |
| “ “ | 0·40 | “ | 60 | “ | 900 | “ |
| “ “ | 0·50 | “ | 51 | “ | 765 | “ |
| “ “ | 0·60 | “ | 45 | “ | 673 | “ |
| “ “ | 0·70 | “ | 40 | “ | 600 | “ |
| “ “ | 0·80 | “ | 36 | “ | 540 | “ |
| “ “ | 0·90 | “ | 32 | “ | 480 | “ |
| “ “ | 1·00 | “ | 29 | “ | 435 | “ |

Under the latter conditions, the advantages of the light gradients, *equated for curvature*, and adopted on the Pacific Railway, are still more apparent. On a gradient of 1·00 per 100 with 4° curves, the train load would be reduced to say 26 cars, with a paying load of 390 tons; while the easy grades in question, on the Pacific Railway, will admit of trains of 51 cars, and about 765 tons paying load.

In designing passenger and freight cars, the importance of interchangeability of parts, and of reducing the number of different sized lumber used, will be kept in view.

Through the courtesy of Mr. Theo. N. Ely, the Superintendent of Motive power of the Pennsylvania Railway, I have been supplied with valuable statistics, and a large number of tracings of their standard passenger engines, &c., and facilities have been most kindly extended to me by Mr. Herbert Wallis, Locomotive Superintendent of the Grand Trunk Railway, whereby I have been enabled to make sketches in the shops and tracings in the office, of such details as are found by experience the most satisfactory.

I have the honor to be, Sir,
Your obedient servant,
CHARLES BLACKWELL.

SANDFORD FLEMING, Esq., C.M.G.,
Engineer-in-Chief.

## JOINT REPORT ON THE STANDARD PASSENGER AND WAY-FREIGHT LOCOMOTIVE ENGINE PROPOSED FOR THE CANADIAN PACIFIC RAILWAY, BY CHARLES BLACKWELL AND G. J. TANDY.

CANADA PACIFIC RAILWAY OFFICE.
OTTAWA, 22nd September, 1879.

DEAR SIR,—The undersigned would recommend you to adopt as a standard type of engine for passenger and way-freight work, upon the Canadian Pacific Railway, the "Class C" engine of the Pennsylvania Railway, with such modifications as to details as we may find expedient, the following being the leading proportions:—

| | |
|---|---|
| Cylinders | 17 in. by 24 in. |
| Four driving wheels 62 in. in diameter over tyres | 8 ft. 6 in. centres. |
| Inside fire-box | 72 in. by 35 in. |
| Tubes 2 in. diameter | 10 ft. 8 ins. long. |
| *Centre of truck or cylinder to centre of driving axle | 11 ft. 2 in. |
| Weight (loaded), on drivers | 50,400 lbs. |
| " " truck | 25,300 " |
| Tender, capacity | 2,400 galls. |
| Total wheel-base, engine and tender | 44 ft. 6 in. |

Yours faithfully,
(Signed) CHARLES BLACKWELL,
" G. J. TANDY.

SANDFORD FLEMING, Esq., C.M.G.,
Engineer-in-Chief.

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* This dimension has since been changed to 11 feet 4 inches.

## APPENDIX No. 20.

A DESCRIPTION OF THE SEVERAL CONTRACTS ENTERED INTO—WITH THE RATES AND PRICES—FOR THE SUPPLY OF MATERIALS AND EXECUTION OF WORK ON THE CANADIAN PACIFIC RAILWAY, SINCE MARCH, 1879, TO THE PRESENT TIME. A DESCRIPTION OF THE CONTRACTS PREVIOUSLY ENTERED INTO, WILL BE FOUND IN THE REPORTS OF FEBRUARY, 1877, PAGES 383 TO 396, AND OF APRIL, 1879, PAGES 126 TO 136.

### CONTRACT No. 43.

**PEMBINA BRANCH.**—For equipping and working the Pembina Branch of the Canadian Pacific Railway—between Selkirk and Emerson, a distance of 85 miles—in lieu of the Government, who were under agreement, dated 3rd August, 1878, with George Stephen (who represented the controlling interest in the St. Paul, Minneapolis and Manitoba Railway Company) to effect these objects; and further, for maintaining and keeping the said line in an efficient and full state of repair. Twenty per cent. of the gross earnings of the line, or such other amount as may be agreed upon, to be paid over to the Government monthly.

| | |
|---|---|
| Name of contractors | Joseph Upper & Co. |
| Date of contract | 12th March, 1879. |
| Term of contract | Until the main line from Fort William to Selkirk is opened for traffic. |

*This contract was cancelled by Order in Council dated 28th January, 1880, to take effect on the 10th February, 1880.*

### CONTRACT No. 44.

**RAILS.**—For the supply of 2,000 tons of steel rails, with the proportionate quantity of steel fishplates, delivered at Montreal. The specification required the rails to be 57½ lbs. per yard, or 90 tons per mile of railway, and to be of the Canadian Pacific Railway standard section.

| | |
|---|---|
| Manufacturers | West Cumberland Iron and Steel Company (Limited). |
| Date of order | 24th June, 1879. |
| Date for delivery | 15th August, 1879. |

The quantities delivered and prices are as follows:—

| | Tons. | cwt. | qrs. | lbs. | | |
|---|---|---|---|---|---|---|
| Rails | 2,000 | 5 | 0 | 17 | | |
| Fishplates | 78 | 19 | 2 | 3 | | |
| | 2,078 | 4 | 2 | 20 | @ £4 19 0 = | £10,287 5 6 |
| Currency | | | | | | $50,064 74 |

All the supplies embraced in this contract have been delivered.

### CONTRACT No. 45.

**RAILS.**—For the supply of 1,500 tons of steel rails, with the proportionate quantity of steel fishplates, delivered at Montreal. The specification required the rails to be 57½ lbs. per yard, or 90 tons per mile of railway, and to be of the Canadian Pacific Railway standard section.

Manufacturers .........Barrow Hœmatite Steel Company (Limited).
Date of order..........25th June, 1879.
Date for delivery......15th August, 1879.

The quantities delivered and prices are as follows:—

| | Tons. | cwt. | qrs. | lbs. | | |
|---|---|---|---|---|---|---|
| Rails.................. | 1,500 | 3 | 2 | 14 | | |
| Fishplates. ......... | 55 | 1 | 2 | 2 | | |
| | 1,555 | 5 | 0 | 16 | @ £5 0 0 = | £7,776 5 9 |
| Currency ........................................................ | | | | | | $37,844 59 |

All the supplies embraced in this contract have been delivered.

## CONTRACT No. 46.

**RAILS.**—For the supply of 1,500 tons of steel rails, with the proportionate quantity of steel fishplates, delivered at Montreal. The specification required the rails to be 57½ lbs. per yard, or 90 tons per mile of railway, and to be of the Canadian Pacific Railway standard section.

Manufacturers..............Ebbw Vale Steel, Iron and Coal Company (Limited).
Date of order...............26th June, 1879.
Date for delivery..........15th August, 1879.

The quantities delivered and prices are as follows:—

| | Tons. | cwt. | qrs. | lbs. | | |
|---|---|---|---|---|---|---|
| Rails.................. | 1,503 | 1 | 1 | 3 | | |
| Fishplates ......... | 57 | 8 | 3 | 9 | | |
| | 1,560 | 10 | 0 | 12 | @ £5 0 0 = | £7,802 10 6 |
| Currency........................................... | | | | | | $37,972 28 |

All the supplies embraced in this contract have been delivered.

## CONTRACT No. 47.

**BOLTS AND NUTS.**—For the supply of 96,000 fishplate bolts and nuts, ¾ inch diameter, 3¾ inches long, cup shaped heads, and square necks and nuts, dipped in oil, and packed in strong 2 cwt. iron-bound cases, and delivered f.o.b. at Newport.

Manufacturers.............Patent Nut and Bolt Company (Limited).
Date of order...............4th July, 1879.
Date for delivery..........25th July, 1879.

The quantities delivered and prices are as follows:—

| | Tons. | cwt. | qrs. | lbs. | | |
|---|---|---|---|---|---|---|
| Delivered.......... | 46 | 16 | 0 | 0 | @ £10 0 0 = | £468 0 0 |
| Currency................................................ | | | | | | $2,227 60 |
| Freight and insurance.............. | | | | | £29 4 0 = | 142 11 |
| Total................................................... | | | | | | $2,419 71 |

All the supplies embraced in this contract have been delivered.

## CONTRACT No. 48.

MAIN LINE.—First 100-mile section west of Red River. The contract embraces all the work necessary to be done in connection with the grading, bridging, track-laying, half-ballasting, station buildings, &c., according to General and Special specifications and provisions of contract. Length 100 miles.

Name of contractor.......................................John Ryan.
Date of contract.........................................19th August, 1879.
Date for completion......................................19th August, 1880.

The approximate quantities furnished to contractors, moneyed out at the contract rates, are as follows:—

### SCHEDULE OF QUANTITIES AND PRICES.

| Description of Work. | Assumed Quantities. | | Rates. | Amount. |
|---|---|---|---|---|
| | | | $ cts. | $ cts. |
| 1. Clearing | Acres ... | 100 | 2 00 per acre. | 200 00 |
| 2. Grubbing | " ... | 50 | 4 00 " | 200 00 |
| 3. Platform of logs across muskegs, average 9 in. deep | " ... | 1 | 750 00 " | 750 00 |
| 4. *Fencing | L. feet.. | 1,000,000 | 0 04 per L. ft. | 40,000 00 |
| 5. Earth excavation | C. yards | 700,000 | 0 16 per C. yd. | 112,000 00 |
| 6. Crib-work, in abutments and piers of bridges, including stone filling | " | 500 | 2 50 " | 1,250 00 |
| 7. Rip-rap | " | 500 | 1 50 " | 750 00 |
| 8. Square timber and plank in trestle-work, culverts, bridges, etc., white pine or Tamarac | C. feet... | 100,000 | 0 28 per C. ft. | 28,000 00 |
| 9. Piles driven, 12 in. by 12 in, tamarac | L. feet.. | 8,000 | 0 50 per L. ft. | 4,000 00 |
| 10. 8 in. flatted timber | " | 2,000 | 0 15 " | 300 00 |
| 11. Wrought iron, including bolts, spikes, straps, etc | Lbs. | 60,000 | 0 07 per lb. | 4,200 00 |
| 12. Cast iron | " | 10,000 | 0 07 " | 700 00 |
| 13. Public road crossings, including cattle-guards and connecting fences, sign-boards, gravelling roadway, &c. | No. | 100 | 145 00 per cross'g | 14,500 00 |
| 14. Farm road crossings, including gates, forming roadway, &c | " | 200 | 10 00 " | 2,000 00 |
| 15. Ties | " | 275,000 | 0 29 per tie. | 79,750 00 |
| 16. Carriage of rails and fastenings from Montreal | Tons. | 11,000 | 17 75 per ton. | 195,250 00 |
| 17. Track-laying | Miles. | 106 | 275 00 per mile. | 29,150 00 |
| 18. *Ballasting | C. yards | 250,000 | 0 22 per C. yd. | 55,000 00 |
| 19. Points and crossings | No. | 50 | 20 00 per set. | 1,000 00 |
| 20. Station buildings, 60 ft. by 24 ft., with platform, complete | " | 14 | 2,250 00 per Stati'n | 31,500 00 |
| Total amount for assumed distance of 100 miles | | | | 600,500 00 |

Amount paid on account of work executed to 31st Dec., 1879, $12,030.00.

---

*No fencing to be done under this contract, and the ballasting is not to exceed 125,000 cubic yards.

## CONTRACT No. 49.

**STATION BUILDINGS**, Pembina Branch. The contract embraces the furnishing of all the necessary plant, material and labor required in the erection and completion of the several buildings and platforms.

| | |
|---|---|
| Name of contractor…… …………………… | Richard Dickso.. |
| Date of contract……………………………… | 15th August, 1879. |
| Date for completion……………… …… …… | 1st November, 1879. |

The buildings and prices are as follows:—

| Miles. | Name of Station. | Description and Dimensions. | Price for each, Complete. | |
|---|---|---|---|---|
| | | | $ | cts. |
| 0 | Emerson………… | Station Building, 120 ft. by 24; platform, 300 ft. by 12 ft. along front, and with end and rear portions …… ……………… | 3,340 | 40 |
| 10 | Penza …… …… | Station Building, 60 ft. by 24; platform, 300 ft. by 12 ft. along front, and with end and rear portions…………………… | 2,030 | 40 |
| 18 | Arnaud… …… … | Platform only, 100 ft. by 12 ft., including raised portions……… | 200 | 00 |
| 26 | Dufrost… ……… | do do do …… | 200 | 00 |
| 35 | Otterburn………… | Station Building, 60 ft. by 24; platform, 300 ft. by 12 ft. along front, and with end and rear portions………… … …… …… | 2,030 | 40 |
| 43 | Niverville………… | Station Building, 60 ft. by 24; platform, 300 ft. by 12 ft. along front, and with end and rear portions…………………… | 2,030 | 40 |
| 54 | St. Norbert……… | Platform only, 100 ft. by 12 ft., including raised portions……… | 200 | 00 |
| 63 | St. Boniface……… | Station Building, 120 ft. by 24; platform, 300 ft. by 12 ft. along front, and with end and rear portions …………………… | 3,340 | 40 |
| 70 | ……………………… | Platform only, 100 ft. by 12 ft., inclnding raised portions……… | 200 | 00 |
| 77 | Gonor……………… | do do do ……… | 200 | 00 |
| 85 | Selkirk …… …… | Station Building, 60 ft. by 24; platform, 300 ft. by 12 ft. along front, and with end and rear portions……………… ……… | 2,030 | 00 |
| | | Total amount of contract……… …… ……… | 15,802 | 40 |
| | | Additional works………………… .. ……… | 263 | 80 |
| | | Total ……… ……………… …………………… | 16,066 | 20 |

Amount paid on account to 31st Dec., 1879, $13,050. This contract has been completed.

## CONTRACT No. 50.

Railway Spike—For the manufacture, and delivery of 700 tons of railway spikes. The specification required the spike to be made from the best refined iron, 6 inches long by ⅝-inch square, and put up securely in iron-bound cases of 2 cwt. each.

| | |
|---|---|
| Manufacturers ……………………… | Miller Brothers & Mitchell. |
| Date of contract……………… …. | 4th September, 1879. |
| Date for delivery………… ……… | Before close of navigation, 1879. |

The quantity delivered and prices are as follows:—

| | Tons. | | |
|---|---|---|---|
| At Montreal……… | 300 (of 2,240 lbs.) | at $47 75 | $14,325 00 |
| At Fort William…. | 400 (of 2,240 lbs.) | at 52 75 | 20,100 00 |
| Amount of contract……………………… | | | $35,425 00 |

This contract has been completed.

## CONTRACT No. 51.

**FISH-PLATE BOLTS AND NUTS.**—For the supply of 35 tons of fish-plate bolts and nuts, delivered at Fort William. The specification required the bolts and nuts to be made from the best refined iron, the bolts to be 3¾ inches long by ¾ inch diameter, having square necks and cup-shaped heads, and screwed for a length of 2 inches; nuts to be 1½ inches square by ⅞ inch thick, the whole dipped in linseed oil and packed in strong iron-bound cases of two cwt. each.

Manufacturers.......................................Dominion Bolt Co.
Date of contract.......................................8th September, 1879.
Date for completion.......................................1st October, 1879.

The quantity delivered and the prices are as follows:—

Bolts and nuts—35½ tons (2,240 lbs.) @ $75............ $2,662 50.

This contract has been completed.

## CONTRACT No. 52.

**TRANSPORTATION OF RAILS.**—From Montreal to Fort William. The contract includes the receiving of the rails, and fastenings from the Ocean steamer's tackle at Montreal, harbor dues at Montreal, canal tolls, insurance and all charges for loading, unloading, and piling at point of delivery.

Name of contractors ..................North-West Transportation Co.
Date of contract...........................30th September, 1879.
Date for completion....................During navigation of 1880.

Estimated amount of contract.......4,000 tons (2,240 lbs.) @ $6=$24,000.

Amount paid on account to 31st Dec., 1879, $15,084.

## CONTRACT No. 53.*

**RAILS.**—For the supply of 30,000 tons of steel rails, with the proportionate quantity of steel fish-plates and bolts and nuts, delivered at Montreal. The specification required the rails to be of the section known as the Canadian Pacific Railway Standard; weight of rail to be 57½ lbs. per yard, general length of rails to be 30, 28, 26 and 24 feet, but 10 per cent. will be received in shorter lengths (22, 20, 19 and 18 feet, in about equal proportion); bolt holes to be drilled (not punched). Rails to be inspected during the whole course of manufacture, and subject to the tests provided in specification.

The fish-plates to be of a section to fit the Canadian Pacific Standard rail, of a similar quality of tough mild steel, subject to such tests as may be required. Each fish-plate to be 20 inches long, punched hot, with four holes, and otherwise made true to template.

The bolts ¾ in. diameter, 3¾ in. long, to be made with cup-heads and square necks; iron to be of a tough, fibrous quality; workmanship and finish of the best description; threads of screws to be Whitworth's standard, ten to the inch. Bolts and nuts to be heated and dipped to prevent rusting, and packed in strong iron-bound cases, to contain not over 2 cwt.

Manufacturers................Barrow Hœmatite Steel Co. (Limited).
Date of contract................30th August, 1879.

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* Contracts Nos. 53, 54 and 55 embrace 45,000 tons of steel rails and fastenings, 11,000 tons of which will be used on the Rivière du Loup Section of the Intercolonial Railway.

The quantities, dates of delivery and prices are as follows:

| Date of Delivery. | Rails. | Rate per Ton of 2,240 lbs. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Rails. | | | Fish-plates. | | | Bolts and Nuts. | | |
| | Tons. | £ | s. | d. | £ | s. | d. | £ | s. | d. |
| October 1, 1879 | 5,000 | 4 | 17 | 6 | 5 | 17 | 6 | 10 | 5 | 0 |
| June 1, 1880 | 5,000 | 5 | 0 | 0 | 6 | 0 | 0 | 10 | 5 | 0 |
| September 1, 1880 | 5,000 | 4 | 17 | 6 | 5 | 17 | 6 | 10 | 5 | 0 |
| do | 5,000 | 5 | 0 | 0 | 6 | 0 | 0 | 10 | 5 | 0 |
| October 1, 1880 | 10,000 | 5 | 2 | 6 | 6 | 2 | 6 | 10 | 7 | 6 |

Estimated cost........................ £160,500 0 0 or say $781,000 00
Of the above there has been delivered 5,101 tons. Value. $123,156 38

## CONTRACT No. 54.*

RAILS.—For the supply of 10,000 tons of steel rails, with the proportionate quantity of steel fish-plates and bolts and nuts, delivered at Montreal. The specification is the same as that for Contract No. 53.

Manufacturers..........................................Guest & Co.
Date of contract..................................11th September, 1879.

The quantities, dates of delivery and prices are as follows:

| Date of Delivery. | Rails. | Rate per Tonof 2,240 lbs. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Rails. | | | Fish-plates. | | | Bolts and Nuts. | | |
| | Tons. | £ | s. | d. | £ | s. | d. | £ | s. | d. |
| October 1, 1879 | 5,000 | 4 | 17 | 6 | 5 | 17 | 6 | 12 | 0 | 0 |
| June 1, 1880 | 5,000 | 5 | 0 | 0 | 6 | 0 | 0 | 12 | 0 | 0 |

Estimated cost ................................ £52,950 or say $258,000 00
Of the above there has been delivered 4,791½ tons. Value. 115,698 35

## CONTRACT No. 55.*

RAILS.—For the supply of 5,000 tons of steel rails, with the proportionate quantity of steel fish-plates and bolts and nuts, delivered at Montreal. The specification is the same as that for Contract No. 53.

Manufacturers............West Cumberland Iron and Steel Co. (Limited).
Date of contract..........29th August, 1879.

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* Contracts Nos. 53, 54 and 55 embrace 45,000 tons of steel rails and fastenings, 11,000 tons of which will be used on the Rivière du Loup Section of the Intercolonial Railway.

The quantities, dates of delivery and prices are as follows.—

| Date of Delivery. | Rails. | Rate per Ton of 2,240 lbs. | | |
|---|---|---|---|---|
| | | Rails. | Fish-plates. | Bolts and Nuts. |
| | Tons. | £ s. d. | £ s. d. | £ s. d. |
| October 1, 1879 | 3,000 | 4 19 0 | 4 19 0 | 9 15 0 |
| November 1, 1879 | 2,000 | 4 19 0 | 4 19 0 | 9 15 0 |

| | | |
|---|---|---|
| Estimated cost | £26,400 0 0 or say | $128,500 00 |
| Of the above there has been delivered 4,363½ tons. | Value | 106,210 54 |

### CONTRACT No. 56.

**IRON SUPERSTRUCTURE.**—For Rat River Bridge, Pembina Branch. The contract embraces the furnishing and erecting in place of one 60-feet span iron bridge.

| | |
|---|---|
| Name of contractors | Kellogg Bridge Co |
| Date of contract | 26th November, 1879. |
| Date for completion | 1st February, 1880. |
| Amount of contract | $1,384.00. |

Amount paid on account to 31st Dec., 1879—Nil.

### CONTRACT No. 57.

**RAILWAY SWITCH FROGS.**—For the supply of 120 patent adjustable railway frogs, with signal frame and switch gear complete, delivered on cars at Truro, N.S.

| | |
|---|---|
| Name of contractors | Truro Patent Frog Co. |
| Date of contract | 27th September, 1879. |
| Date for completion | 1st May, 1880. |

Amount of contract:—

| | |
|---|---|
| 120 Frogs, at $65 | $7,800 00 |
| 120 sets switch frames and gearing, complete, at $35 | 4,200 00 |
| Total | $12,000 00 |

Amount paid on account to 31st Dec., 1879—Nil.

### CONTRACT No. 58.

**TURN-TABLES.**—For the manufacture of 4 iron turn-tables, 50 feet diameter. The contract embraces the manufacture, carriage and erection in place, complete.

| | |
|---|---|
| Name of contractor | W. Hazlehurst. |
| Date of contract | 26th February, 1880. |
| Date for completion | |

Amount of contract:—

| | |
|---|---|
| 1 Decked turn-table | $2,016 00 |
| 3 Open do at $1,360 | 4,080 00 |
| | $6,096 00 |

Amount paid on account to 31st Dec., 1879—Nil.

## CONTRACT No. 59.

**SLEEPERS.**—For the supply of 100,000 railway ties, and the delivery of the same along side of the track on Contract No. 14. These ties are for use on the second 100 miles west of Red River, and will be handed over to the contractor for the section, at the contract price. The ties are to be 8 feet long, flatted on two opposite sides to a uniform thickness of 6 inches, the flatted surface being not less than 6 inches, on either side, at the small end.

| | |
|---|---|
| Name of contractors | Whitehead, Ruttan and Ryan. |
| Date of contract | 6th February, 1880. |
| Date for completing | In time to be taken across ice-bridge on Red River in spring of 1880. |
| Amount of contract | 100,000 ties, at 27¾ cts. each=$27,750. |

Amount paid on account to 31st Dec., 1879—Nil.

## CONTRACT No. 60.

**MAIN LINE**, in British Columbia, extending from Emory's Bar to Boston Bar.—The contract embraces all the works necessary in connection with the excavating, grading, tunnelling, bridging, track-laying and ballasting according to the General Specification. Length, 29 miles.

| | |
|---|---|
| Name of contractor | Andrew Onderdonk. |
| Date of contract | 23rd December, 1879. |
| Date for completion | 31st December, 1883. |

The approximate quantities furnished to contractors, moneyed out at contract rates, are as follows:—

### SCHEDULE OF QUANTITIES AND PRICES.

| Description of Work. | *Approximate Quantities. | | Rates. | | Amount. |
|---|---|---|---|---|---|
| | | | | $ cts. | $ cts. |
| Clearing | Acres. | 250 | Per acre | 30 00 | 7,500 00 |
| Close cutting | do | 10 | do | 40 00 | 400 00 |
| Grubbing | do | 10 | do | 80 00 | 800 00 |
| Fencing | L. feet. | 10,000 | Per l. ft. | 0 05 | 500 00 |
| Solid rock excavation | C.yards. | 500,000 | Per c.yd | 1 50 | 750,000 00 |
| Loose do do | do | 250,000 | do | 0 75 | 187,500 00 |
| Earth excavation, including that described in clause 13 of specification | do | 1,500,000 | do | 30 0 | 450,000 00 |
| Under-drains | L. feet. | 2,000 | Per l. ft. | 0 40 | 800 00 |
| Tunnelling (see clause 32 of specification)— | | | | | |
| "Line tunnels" in rock, in the following lengths: 300 ft., 50, 150, 105, 240, 400, 360, 385, 290, 200, 150, 140, 1,600, 160, 150, 100, 110, 230, 350 and 500 feet | do | Say 6,000 | do | 105 00 | 630,000 00 |
| "Twelve feet—stream tunnels" | do | 200 | do | 36 00 | 7,200 00 |
| "Six feet—stream tunnels" | do | 1,000 | do | 12 00 | 12,000 00 |
| Bridge masonry | C.yards. | 15,000 | Per c.yd | 10 00 | 150,000 00 |
| Culvert masonry | do | 10,000 | do | 6 00 | 60,000 00 |
| Carried forward | | | | | 2,256,700 00 |

## SCHEDULE OF QUANTITIES AND PRICES.—*Concluded.*

| Description of Work. | *Approximate Quantities. | | Rates. | | Amount. |
|---|---|---|---|---|---|
| | | | | $ cts. | $ cts. |
| Brought forward | ........ | ........ | ........ | ........ | 2,256,700 00 |
| Dry masonry (retaining walls, etc) | C. yards | 5,000 | Per c.yd | 4 00 | 20,000 00 |
| Paving. | do | 1,000 | do | 3 00 | 3,000 00 |
| Concrete. | do | 1,000 | do | 6 00 | 6,000 00 |
| Rip-rap | do | 1,000 | do | 3 00 | 3,000 00 |
| Cast-iron pipes, 3 ft. diameter inside, 1 in thick, laid in concrete (the concrete not included in this item | L. feet. | 500 | Per l. ft. | 10 00 | 5,000 00 |
| Hand-laying rock embankments where slopes aresteeper than 1 to 1 (labor only) | C. yards | 15,000 | Per c.yd | 0 75 | 11,250 00 |
| Timber, bridge superstructure, 150 feet clear | No. | 8 | Per span | 7,500 00 | 60,000 00 |
| do do 125 do | do | 1 | do | 6,250 00 | 6,250 00 |
| do do 100 do | do | 6 | do | 4,000 00 | 24,000 00 |
| do do 60 do | do | 1 | do | 2,100 00 | 2,100 00 |
| do do 40 do | do | 3 | do | 1,400 00 | 4,200 00 |
| (See clauses 42 and 43 of specification.) | | | | | |
| Timber, best quality, for beam culverts, etc.— | | | | | |
| 12 in. × 16 in. | L. feet. | 2,000 | Per l ft. | 0 30 | 600 00 |
| 12 in. × 12 in. | do | 5,000 | do | 0 30 | 1,500 00 |
| 8 in. × 16 in. | do | 1,500 | do | 0 25 | 375 00 |
| 8 in. × 12 in. | do | 1,400 | do | 0 25 | 350 00 |
| Other dimensions of timber (if required to be used), at proportionate prices. | | | | | |
| Piles, driven (see clause 40 of specification) | do | 10,000 | do | 0 40 | 4,000 00 |
| Round timber, for crib-wharfing, etc., not less than 12 inches diameter | do | 10,000 | do | 0 20 | 2,000 00 |
| Flatted timber in road diversion culverts, 12 in thick. | do | 3,000 | do | 0 25 | 750 00 |
| Plank | Ft. B.M. | 20,000 | Per M. | 25 00 | 500 00 |
| Wrought iron | Lbs. | 3,000 | Per lb. | 0 15 | 450 00 |
| Cast iron | do | 500 | do | 0 15 | 75 00 |
| Ties | No. | 75,000 | Each. | 0 30 | 22,500 00 |
| Carriage of rails and fastenings from lower end of Section, including all handling. | Tons. | 3,000 | Per ton. | 1 00 | 3,000 00 |
| Track-laying | Miles. | 30 | Miles. | 300 00 | 9,000 00 |
| Ballasting | C. yards | 100,000 | Per c.yd | 0 30 | 30,000 00 |
| Setting points and crossings | No. | 20 | Each. | 25 00 | 500 00 |
| Public road level crossings, comprising timber cattle-guards, planking, small timber culverts under approaches, and notice-boards, complete | do | 4 | do | 50 00 | 200 00 |
| To cover work which possibly may be required under clauses 18, 43 and 91 of general specification, short quantities and contingencies—add, say, $250,000 | ........ | ........ | ........ | ........ | 250,000 00 |
| Total. | ........ | ........ | ........ | ........ | 2,727,300 00 |

Operations had not commenced at end of April, 1880.

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*Some of the quantities printed in this column are estimated from preliminary location measurements, and may be considered roughly approximate; other items are simply conjectured, and placed herein for the purpose of obtaining rates.

## CONTRACT No. 61.

**MAIN LINE**, in British Columbia, extending from Boston Bar to Lytton.—The contract embraces all the works necessary in connection with the excavating, grading, tunnelling, bridging, track-laying and ballasting, according to the General Specification. Length, 29 miles.

Name of contractors........................Ryan, Goodwin & Co.
Date of contract ............................10th February, 1880.
Date for completion .........................30th June, 1884.

The approximate quantities furnished to contractors, moneyed out at contract rates, are as follows:—

### SCHEDULE OF QUANTITIES AND PRICES.

| Description of Work. | *Approximate Quantities. | | Rates. | | Amount. |
|---|---|---|---|---|---|
| | | | | $ cts. | $ cts. |
| Clearing | Acres. | 400 | Per acre | 25 00 | 10,000 00 |
| Close cutting | do | 10 | do | 30 00 | 300 00 |
| Grubbing | do | 10 | do | 100 00 | 1,000 00 |
| Fencing | L. feet. | 10,000 | Per l. ft. | 0 06 | 600 00 |
| Solid rock excavation | C. yards | 200,000 | Per c.yd | 1 80 | 360,000 00 |
| Loose rock excavation | do | 300,000 | do | 0 75 | 225,000 00 |
| Earth excavation (including that described in clause 13 of specification) | do | 3,000,000 | do | 0 30 | 900,000 00 |
| Under-drains | L. feet. | 2,000 | Per l ft. | 0 40 | 800 00 |
| Tunnelling (see clause 32 of specification)— | | | | | |
| "Line tunnels" | do | 600 | do | 120 00 | 72,000 00 |
| "Twelve feet—stream tunnels" | do | 100 | do | 50 00 | 5,000 00 |
| "Six feet—stream tunnels" | do | 500 | do | 20 00 | 10,000 00 |
| Bridge masonry | C. yards | 25,000 | Per c.yd | 12 00 | 300,000 00 |
| Culvert masonry | do | 10,000 | do | 8 00 | 80,000 00 |
| Dry masonry (retaining walls, &c.) | do | 25,000 | do | 3 00 | 75,000 00 |
| Paving | do | 1,000 | do | 2 50 | 2,500 00 |
| Concrete | do | 1,000 | do | 7 00 | 7,000 00 |
| Rip-rap | do | 30,000 | do | 2 00 | 60,000 00 |
| Cast-iron pipes, 3 ft. diameter inside, 1 in. thick, laid in concrete (the concrete not included in this item) | L. feet. | 500 | Per l. ft. | 30 00 | 15,000 00 |
| Hand-laying rock embankments, where slopes are steeper than 1 to 1 (labor only) | C. yards | 1,000 | Per c.yd | 0 50 | 500 00 |
| Timber bridge superstructure, 150 ft. clear | No. | 1 | Per span | 5,800 00 | 5,800 00 |
| do do 125 do | do | 1 | do | 4,200 00 | 4,200 00 |
| do do 100 do | do | 34 | do | 3,000 00 | 102,000 00 |
| do do 60 do | do | 1 | do | 1,500 00 | 1,500 00 |
| do do 40 do | do | 1 | do | 1,000 00 | 1,000 00 |
| (See clauses 42 and 43 of specification.) | | | | | |
| Timber, best quality, for beam culverts, &c.— | | | | | |
| 12 in. × 16 in | L. feet. | 200 | Per l. ft. | 0 60 | 120 00 |
| 12 in. × 12 in | do | 2,000 | do | 0 45 | 900 00 |
| 8 in × 16 in | do | 200 | do | 0 40 | 80 00 |
| 8 in. × 12 in | do | 200 | do | 0 30 | 60 00 |
| Other dimensions of timber (if required to be used) at proportionate prices. | | | | | |
| Piles driven (see clause 40 of specification) | do | 10,000 | do | 0 50 | 5,000 00 |
| Carried forward | | | | | 2,245,360 00 |

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* *See* foot note next page.

## SCHEDULE OF QUANTITIES AND PRICES.—*Concluded.*

| Description of Work. | *Approximate Quantities. | | Rates. | | Amount |
|---|---|---|---|---|---|
| | | | | $ cts. | $ cts. |
| Brought forward | | | | | 2,245,360 00 |
| Round timber for crib wharfing, etc., not less than 12 in. diameter | do | 10,000 | do | 0 30 | 3,000 00 |
| Flatted timber in road diversion culverts, 12 in. thick | do | 3,000 | do | 0 25 | 750 00 |
| Plank | Ft. B.M. | 10,000 | Per M. | 30 00 | 300 00 |
| Wrought iron | Lbs. | 1,000 | Per lb. | 0 12 | 120 00 |
| Cast iron | do | 100 | do | 0 10 | 10 00 |
| Ties | No. | 75,000 | Each. | 0 30 | 22,500 00 |
| Carriage of rails and fastenings from lower end of Section, including all handling. | Tons. | 3,000 | Per ton. | 1 00 | 3,000 00 |
| Track-laying | Miles. | 30 | Per mile | 250 00 | 7,500 00 |
| Ballasting | C. yards | 100,000 | Per c yd | 0 40 | 40,000 00 |
| Setting points and crossings | No. | 20 | Each. | 40 00 | 800 00 |
| Public road level crossings, comprising timber cattle-guards, planking, small timber culverts under approaches, and notice boards, complete | do | 2 | Each. | 150 00 | 300 00 |
| To cover work which possibly may be required under clauses 18, 43 and 91 of general specification, short quantities and contingencies—add, say, $250,000 | | | | | 250,000 00 |
| Total | | | | | 2,573,640 00 |

Operations had not commenced at end of April, 1880.

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* Some of the quantities printed in this column are estimated from preliminary location measurements, and may be considered roughly approximate; other items are simply conjectured and placed herein for the purpose of obtaining rates.

## CONTRACT No. 62.

MAIN LINE, in British Columbia, extending from Lytton to Junction Flat. The contract embraces all the works necessary in connection with the excavation, grading, tunnelling, bridging, track-laying and ballasting, according to General Specification. Length, 28½ miles.

Name of Contractor.........................Andrew Onderdonk.
Date of Contract...........................23rd December, 1879.
Date for Completion.......................31st December, 1884.

The approximate quantities furnished to contractors, moneyed out at contract rates, are as follows:—

### SCHEDULE OF QUANTITIES AND PRICES.

| Description of Work. | *Approximate Quantities. | | Rates. | | Amount. |
|---|---|---|---|---|---|
| | | | | $ cts. | $ cts. |
| Clearing | Acres. | 200 | Per acre | 40 00 | 8,000 00 |
| Close cutting | do | 10 | do | 50 00 | 500 00 |
| Grubbing | do | 10 | do | 100 00 | 1,000 00 |
| Fencing | L. ft. | 10,000 | Per l. ft. | 0 05 | 500 00 |
| Solid rock excavation | C. yds. | 200,000 | Per c. yd | 1 60 | 320,000 00 |
| Loose do | do | 100,000 | do | 0 80 | 80,000 00 |
| Earth excavation (including that described in clause 13 of specification) | do | 2,500,000 | do | 0 30 | 750,000 00 |
| Under-drains | L. ft. | 2,000 | Per l. ft. | 0 40 | 800 00 |
| Tunnelling (see clause 32 of specification)— "Line tunnels" | do | 400 | do | 105 00 | 42,000 00 |
| Bridge masonry | C. yds. | 15,000 | Per c. yd | 12 00 | 180,000 00 |
| Culvert do | do | 10,000 | do | 7 00 | 70,000 00 |
| Dry masonry (retaining walls, &c.) | do | 30,000 | do | 4 00 | 120,000 00 |
| Paving | do | 1,000 | do | 3 00 | 3,000 00 |
| Concrete | do | 1,000 | do | 6 00 | 6,000 00 |
| Rip-rap | do | 20,000 | do | 2 00 | 40,000 00 |
| Cast-iron pipes, 3 ft. diameter inside, 1 in. thick, laid in concrete (the concrete not included in this item) | L. ft. | 500 | Per l. ft. | 10 00 | 5,000 00 |
| Hand-laying rock embankments, where slopes are steeper than 1 to one (labour only) | C. yds. | 1,000 | Per c. yd | 1 00 | 1,000 00 |
| Timber bridge superstructure, 150 ft. clear | No. | 2 | Per span | 7,500 00 | 15,000 00 |
| do do 100 do | do | 19 | do | 4,000 00 | 76,000 00 |
| do do 60 do | do | 1 | do | 2,100 00 | 2,100 00 |
| do do 50 do | do | 2 | do | 2,100 00 | 4,200 00 |
| do do 40 do | do | 1 | do | 1,400 00 | 1,400 00 |
| do do 30 do | do | 1 | do | 1,400 00 | 1,400 00 |
| (See clauses 42 and 43 of specification.) | | | | | |
| Timber, best quality, for beam culverts, &c.— | | | | | |
| 12 in. × 16 in. | L. ft. | 1,000 | Per l. ft. | 0 40 | 400 00 |
| 12 in. × 12 in. | do | 5,000 | do | 0 40 | 2,000 00 |
| 8 in. × 16 in. | do | 1,000 | do | 0 30 | 300 00 |
| 8 in. × 12 in. | do | 1,000 | do | 0 30 | 300 00 |
| Other dimensions of timber (if required to be used) at proportionate prices. | | | | | |
| Piles driven (see clause 40 of specification) | do | 10,000 | do | 0 40 | 4,000 00 |
| Round timber for crib wharfing, &c., not less than 12 in. diameter | do | 10,000 | do | 0 25 | 2,500 00 |
| Flatted timber in road diversion culverts, &c., 12 in. thick | do | 10,000 | do | 0 30 | 3,000 00 |
| Carried forward | | | | | 1,740,600 00 |

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* *See* foot note next page.

## SCHEDULE OF QUANTITIES AND PRICES.—*Concluded.*

| Description of Work. | *Approximate Quantities. | | Rates. | | Amount. |
|---|---|---|---|---|---|
| | | | | $ cts. | $ cts. |
| Brought forward | | | | | 1,740,400 00 |
| Plank | Ft. B.M. | 20,000 | Per M. | 25 00 | 500 00 |
| Wrought iron | Lbs. | 3,000 | Per lb. | 0 20 | 600 00 |
| Cast iron | do | 500 | do | 0 20 | 100 00 |
| Ties | No. | 75,000 | Each. | 0 30 | 22,500 00 |
| Carriage of rails and fastenings, from lower end of section, including all handling | Tons. | 3,000 | Per ton. | 1 00 | 3,000 00 |
| Tracklaying | Miles. | 30 | Per mile | 300 00 | 9,000 00 |
| Ballasting | C. yds. | 100,000 | Per c. yd | 0 30 | 30,000 00 |
| Siding points and crossings | No. | 20 | Each. | 25 00 | 500 00 |
| Public road level crossings, comprising timber cattle-guards, planking, small timber culvert under approaches, and notice-boards, complete | do | 7 | do | 50 00 | 350 00 |
| To cover work which possibly may be required under clauses 18, 43 and 91 of General Specification, short quantities, cofferdams and contingencies, add, say, $250,000 | | | | | 250,000 00 |
| Total | | | | | 2,056,950 00 |

Operations had not commenced at end of April, 1880.

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*Some of the quantities printed in this column are estimated from preliminary location measurements, and may be considered roughly approximate; other items are simply conjectured and placed herein for the purpose of obtaining rates.

## CONTRACT No. 63.

MAIN LINE, in British Columbia, extending from Junction Flat to Savona's Ferry. The contract embraces all the works necessary in connection with the excavation, grading, tunnelling, bridging, track-laying, and ballasting, according to General Specification. Length, 40½ miles.

Name of contractor....... ..................Andrew Onderdonk.
Date of contract..............................15th December, 1879.
Date for completion.......... ..............30th June, 1885.

The approximate quantities furnished to contractors, moneyed out at contract rates, are as follows:—

### SCHEDULE OF QUANTITIES AND PRICES.

| Description of Work. | * Approximate Quantities. | | Rates. | | Amount. |
|---|---|---|---|---|---|
| | | | | $ cts. | $ cts. |
| Clearing | Acres. | 25 | Per acre. | 30 00 | 750 00 |
| Close cutting | do | 5 | do | 40 00 | 200 00 |
| Grubbing | do | 5 | do | 50 00 | 250 00 |
| Fencing | L. feet. | 10,000 | Per l. ft. | 0 06 | 600 00 |
| Solid rock excavation | C. yards | 100,000 | Per c. yd | 1 75 | 175,000 00 |
| Loose rock excavation | do | 50,000 | do | 0 75 | 37,500 00 |
| Earth excavation, (including that described in clause 13 of specification) | do | 3,000,000 | do | 0 27 | 810,000 00 |
| Under-drains | L. feet. | 2,000 | Per l. ft. | 0 20 | 400 00 |
| Tunnelling (see clause 32 of specification)— | | | | | |
| "Line tunnels" This tunnel will be formed in earth. The price per lineal foot of tunnel must cover excavation, centering, masonry and all expenses | do | 250 | do | 60 00 | 15,000 00 |
| "Twelve feet—stream tunnels" | do | 100 | do | 20 00 | 2,000 00 |
| "Six feet—stream tunnels" | do | 100 | do | 15 00 | 1,500 00 |
| Bridge masonry | C. yards | 10,000 | Per c. yd | 10 50 | 105,000 00 |
| Culvert masonry | do | 5,000 | do | 10 00 | 50,000 00 |
| Dry masonry (retaining walls, etc) | do | 5,000 | do | 8 00 | 40,000 00 |
| Paving | do | 1,000 | do | 5 00 | 5,000 00 |
| Concrete | do | 1,000 | do | 5 50 | 5,500 00 |
| Rip-rap | do | 15,000 | do | 2 75 | 41,250 00 |
| Cast-iron pipes, 3ft diameter inside, 1 inch thick, laid in concrete (the concrete not included in this item) | L. feet. | 500 | Per l. ft. | 18 00 | 9,000 00 |
| Hand-laying rock embankments, where slopes are steeper than 1 to 1 (labour only) | C. yards | 1,000 | Per c. yd | 2 75 | 2,750 00 |
| Timber bridge superstructure, 200 ft. clear | No. | 2 | Per span | 8,000 00 | 16,000 00 |
| do do 150 do | do | 1 | do | 6,000 00 | 6,000 00 |
| do do 125 do | do | 1 | do | 5,000 00 | 5,000 00 |
| do do 100 do | do | 1 | do | 3,500 00 | 3,500 00 |
| do do 60 do | do | 1 | do | 2,100 00 | 2,100 00 |
| (See clauses 42 and 43 of specification ) | | | | | |
| Timber, best quality, for beam culverts, &c.— | | | | | |
| 12 in. × 16 in | L. feet. | 1,000 | Per l ft. | 0 50 | 500 00 |
| 12 in. × 12 in | do | 50,000 | do | 0 40 | 20,000 00 |
| 8 in. × 16 in | do | 15,000 | do | 0 30 | 4,500 00 |
| 8 in. × 12 in | do | 50,000 | do | 0 30 | 15,000 00 |
| 8 in. × 10 in | do | 50,000 | do | 0 25 | 12,500 00 |
| Carried forward | | | | | 1,386,800 00 |

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* *See* foot note next page.

SCHEDULE OF QUANTITIES AND PRICES.—*Concluded.*

| Description of Work. | *Approximate Quantities. | | Rates | | Amount. |
|---|---|---|---|---|---|
| | | | | $ cts. | $ cts. |
| Brought forward………… | ………… | ………… | ………… | ………… | 1,386,800 00 |
| Other dimensions of timbers (if required to be used) at proportionate prices. | | | | | |
| Piles driven (see clause 40 of specification)…. | L. feet. | 10,000 | Per l. ft. | 0 40 | 4,000 00 |
| Round timber for crib wharfing, not less than 12 inches in diameter ……… | do | 10,000 | do | 0 25 | 2,500 00 |
| Flatted timber in road diversion culverts, 12 in. thick ……… | do | 10,000 | do | 0 30 | 3,000 00 |
| Plank ……… | Ft. B. M. | 200,000 | Per M. | 35 00 | 7,000 00 |
| Wrought iron. ……… | Lbs. | 50,000 | Per lb. | 0 12 | 6,000 00 |
| Cast iron ……… | do | 10,000 | do | 0 10 | 1,000 00 |
| Ties ……… | No. | 100,000 | Each. | 0 25 | 25,000 00 |
| Carriage of rails and fastenings, from lower end of section, including all handling…… | Tons. | 4,000 | Per ton. | 3 00 | 12,000 00 |
| Track-laying. ……… | Miles. | 42 | Per mile. | 300 00 | 12,600 00 |
| Ballasting ……… | C. yards | 130,000 | Per c. yd | 0 27 | 35,100 00 |
| Setting points and crossings.. ……… | No. | 25 | Each. | 30 00 | 750 00 |
| Public road level crossings, comprising timber cattle guards, planking, small timber culvert under approaches, and notice-boards, complete. ……… | do | 2 | do | 200 00 | 400 00 |
| To cover work which possibly may be required under clauses 18, 43 and 91 of General Specification, short quantities, cofferdams, contingencies, etc., say $250,000……… | ………… | ………… | ………… | ………… | 250,000 00 |
| Total……… | ………… | ………… | ………… | ………… | 1,746,150 00 |

Operations had not commenced at end of April, 1880.

*Some of the quantities printed in this column are estimated from preliminary location measurements, and may be considered roughly approximate. Other items are simply conjectured and placed herein for the purpose of obtaining rates.

## CONTRACT No. 64.

**TEMPORARY BRIDGE** over Red River.—The contract embraces the furnishing of all the necessary plant, materials and labour required in building a pile trestle bridge over the Red River at Winnipeg, the structure to be completed and made ready to receive the rails.

Name of contractors ……………Ryan, Whitehead & Ruttan.
Date of contract……………18th March 1880.
Date for completion……………15th May, 1880.

Amount of contract …………………… $7,350 00

## CONTRACT No. 65.

ROLLING STOCK.—The contract embraces all the necessary labour, machinery and other plant, materials, articles and things necessary for the construction and completion of Four first class passenger cars, to carry 64 passengers each, and One official car; all to be constructed and finished in accordance with the specifications and designs, and having the "Westinghouse Automatic Air-Brake" attached.

| | |
|---|---|
| Name of contractor | James Crossen. |
| Date of contract | 15th March, 1880. |
| Date for completion | 1st June, 1880. |

Amount of contract:—

| | |
|---|---|
| Four first class cars | $18,984 00 |
| One official car | 5,977 00 |
| Total | $24,961 00 |

## CONTRACT No. 66.

MAIN LINE.—Second 100 miles west of Red River. The contract embraces the work necessary to be done in connection with the grading, bridging, track-laying, ballasting, &c., according to the General specification, memorandum and terms of contract. Length, 100 miles.

| | |
|---|---|
| Names of Contractors | Bowie & McNaughton. |
| Date of Contract | 3rd May, 1880. |
| Date for completion | 1st October, 1882. |

The approximate quantities furnished to Contractors, moneyed out at the contract rates, are as follows:—

### SCHEDULE OF QUANTITIES AND PRICES.

| Description of Work. | Approximate Quantities. | | Rates. | | Amount. |
|---|---|---|---|---|---|
| | | | $ cts. | | $ cts. |
| Clearing | Acres. | 190 | 20 00 | Per acre | 3,800 00 |
| Close cutting | do | 10 | 15 00 | do | 150 00 |
| Grubbing | do | 9 | 30 00 | do | 270 00 |
| Platform of logs across muskegs, average 16 in. deep | do | 2 | 500 00 | do | 1,000 00 |
| Earth excavation, including borrowing, surface and catch-water drains, foundations, stations, &c | C. yards | 1,630,000 | 0 16 | Per c yd | 260,800 00 |
| Under-drains | L. feet. | 1,000 | 0 40 | Per l. ft. | 400 00 |
| Crib-work in abutments and piers of bridges, including stone filling | C. yards | 1,000 | 4 00 | Per c. yd | 4,000 00 |
| Rip-rap | do | 300 | 2 50 | do | 750 00 |
| Bridge superstructure, Howe Truss, 100 ft | Spans. | 1 | 3,500 00 | Per span | 3,500 00 |
| do do 80 ft | do | 1 | 2,400 00 | do | 2,400 00 |
| Carried forward | | | | | 277,070 00 |

SCHEDULE OF QUANTITIES AND PRICES.—*Continued.*

| Description of Work. | Approximate Quantities. | | Rates. | | Amount. |
|---|---|---|---|---|---|
| | | | $ cts. | | $ cts. |
| Brought forward | ........ | ........ | ........ | | 277,070 00 |
| Piles driven | L. feet. | 1,780 | 0 25 | Per l. ft. | 445 00 |
| Square timber in trestle-bridges | C. feet. | 180,000 | 0 19 | Per c. ft. | 34,200 00 |
| Spruce plank | S. feet. | 16,000 | 15 00 | Per M. | 240 00 |
| Hardwood plank | do | 2,000 | 30 00 | do | 60 00 |
| Wrought iron | Lbs. | 71,300 | 0 08 | Per lb. | 5,704 00 |
| Cast iron | do | 21,500 | 0 07 | do | 1,505 00 |
| Public road crossings | No. | 50 | 22 00 | Per crossing | 1,100 00 |
| Private do | do | 100 | 10 00 | Per crossing | 1,000 00 |
| Ties, contracted for by Department, to be transferred and delivered at west end of 1st 100-mile section on its completion, at 27¾ cents each | do | 100,000 | 0 27¾ | Per tie. | 27,750 00 |
| Ties to be furnished and delivered on this section | do | 160,000 | 0 20 | do | 32,000 00 |
| Carriage of rails, fastenings, &c., average haul 50 miles | Tons. | 10,400 | 1 00 | Per ton. | 10,400 00 |
| Track-laying, including station sidings | Miles. | 104 | 180 00 | Per mile | 18,720 00 |
| Ballasting, 104 miles, 1,500 cubic yards per mile | C. yards | 156,000 | 0 18 | Per c.yd | 28,080 00 |
| Setting points and crossings, switch gear signal frame, &c | No. | 32 | 20 00 | Per set. | 640 00 |
| Total amount of tender for the section of 100 miles | | | | | 438,914 00 |

## CONTRACT No. 67.

ROLLING STOCK.—The contract embraces all the necessary labour, machinery and other plant, materials, articles and things necessary for the construction and completion of Sixty box freight cars, and Sixty platform freight cars; all to be constructed, finished and delivered according to specification and drawings.

| | |
|---|---|
| Names of Contractors | Moncton Car Co. |
| Date of Contract | 31st March, 1880. |
| Date for completion | 15th June, 1880. |

Amount of contract:—

| | |
|---|---|
| 60 box freight cars, at $690 each | $41,400 00 |
| 60 platform freight cars, at $490 each | 29,400 00 |
| Total | $70,800 00 |

# APPENDIX No. 21.

FORM OF CONTRACT FOR GRADING, BRIDGING, TRACK-LAYING, BALLASTING, &C., ADOPTED IN ALL CASES SINCE NOVEMBER, 1878, EMBRACING THE FOLLOWING.

Contract No. 41, 7th March, 1879—English River to Eagle River, 118 miles.
No. 42, 20th March, 1879—Eagle River to Keewatin, 67 miles.
No. 48, 19th Aug., 1879—First 100 mile section West of Red River, 100 miles
No. 60, 23rd Dec., 1879—Emory's Bar to Boston Bar, B.C., 29 miles.
No. 61, 10th Feb., 1880—Boston Bar to Lytton, B.C., 29 miles.
No. 62, 23rd Dec., 1879—Lytton to Junction Flat, B.C., 28½ miles.
No. 63, 15th Dec., 1879—Junction Flat to Savona's Ferry, B.C., 40½ miles
No. 66, 3rd May, 1880—Second 100 mile section West of Red River, 100 m.

THIS INDENTURE made the day of
one thousand eight hundred and between
* * * * * * *
hereafter called "the Contractor" of the first part, and Her Majesty Queen Victoria represented herein by the Minister of Public Works of Canada, of the second part, *Witnesseth*, that in consideration of the covenants and agreements on the part of Her Majesty hereinafter contained, the Contractor convenant and agree with Her Majesty as follows:

**Work.** 1. In this contract the word "work" or "works" shall, unless the context require a different meaning, mean the whole of the work and the materials, matters and things required to be done, furnished and performed by the Contractor under this contract. **Engineer.** The word "Engineer," shall mean the Chief Engineer for the time being having control over the work, and shall extend to and include any of his assistants acting under his instructions, and all instructions or directions, or certificates given, or decisions made by any one acting for the Chief Engineer, shall be subject to his approval, and may be cancelled, altered, modified and changed, as to him may seem fit.

**On whom Binding.** 2. All covenants and agreements herein contained shall be binding on and extend to the executors and administrators of the Contractor and shall extend to and be binding upon the successors of Her Majesty, and wherever in this contract Her Majesty is referred to, such reference shall include her successors, and wherever the Contractor referred to, such reference shall include executors and administrators.

**Labour, plant and material.** 3. That the Contractor will, at own expense, provide all and every kind of labour, machinery and other plant, materials, articles, and things whatsoever necessary for the due execution and completion of all and every the works set out or referred to in the General Specifications hereunto annexed, dated 30th November, 1878, and marked A, and set out or referred to in the plans and drawings prepared and to be prepared for the purposes of the work, and*

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*A special memorandum is generally furnished in each case when tenders are invited, giving a description of the locality where the line is projected, and other information respecting any special works not referred to in the General Specification.

NOTE.—Since the 1st October, 1879, when the Department of Public Works was divided, the words "Railways and Canals" have been substituted for "Public Works."

in accordance with the printed memorandum herewith annexed, dated , marked B, and will execute and fully complete the respective portions of such works and deliver the same complete to Her Majesty, on or before the * *

Time for completion.

* * * * * *

Materials and workmanship.

The said work to be constructed of the best materials of their several kinds, and finished in the best and most workmanlike manner, in the manner required by and in strict conformity with the said specifications and drawings which may from time to time be furnished (which said specifications and memorandum are hereby declared to be part of this contract); and to the complete satisfaction of the Chief Engineer for the time being having control over the work.

Omissions to be made good.

4. The aforesaid specification and memorandum, and the accepted tender herewith annexed, marked C, and the several parts of this contract shall be taken together, to explain each other, and to make the whole consistent; and if it be found that anything has been omitted or mis-stated, which is necessary for the proper performance and completion of any part of the work contemplated, the Contractor will, at own expense, execute the same as if it had been properly described, and the decision of the Engineer shall be final as to any such error or omission, and the correction of any such error or omission, shall not be deemed to be an addition to or deviation from, the works hereby contracted for.

Engineer may order extra work, and make changes.

5. The Chief Engineer, with the sanction of the Minister of Public Works, shall be at liberty at any time, either before the commencement or during the construction of the works or any portion thereof, to order any work to be done, and to make any changes which he may deem expedient in the grades, the width of cuttings and fillings, the dimensions, character, nature, location, or position of the works, or any part or parts thereof, or in any other thing connected with the works, whether, or not, such changes diminish the work to be done, or the cost of doing the same, and the Contractor shall immediately comply with all written requisitions of the Engineer in that behalf, but the Contractor shall not make any change in or addition to, or omission, or deviation from the works, unless directed by the Engineer, and shall not be entitled to any payment for any change, addition, or deviation, unless such change, addition, omission, or deviation, shall have been first directed in writing by the Engineer, and notified to the Contractor in writing, nor unless the price to be paid for any additional work shall have been previously fixed by the Minister of Public Works in writing, and the decision of the Engineer as to whether any such change or deviation increases or diminishes the cost of the work, and as to the amount to be paid or deducted, as the case may be, in respect thereof, shall be final, and the obtaining of his certificate shall be a condition precedent to the right of the Contractor to be paid therefor. If any such change or alteration constitutes, in the opinion of the said Engineer, a deduction from the works, his decision as to the amount to be deducted on account thereof shall be final and binding.

Changes shall not invalidate contract.

6. That all the clauses of this contract shall apply to any changes, additions, or deviations, in like manner, and to the same extent, as to the works at present projected, and no changes, additions, deviations or variations shall annul or invalidate this contract.

Limit of expenditure under this contract.

7. It being the intention that the cost of the work to be done under this contract be limited to the sum of * * * * which sum is to be taken as the maximum amount of this contract, not to be exceeded; it is hereby specially agreed that should it, at any time during the execution of the said work, appear from the cost of the work then performed, as compared with the value of the works still to be done, that such maximum amount will be exceeded, whether by reason of additions, alterations, variations, for any other cause whatsoever, the Contractor will then be required to complete only such

portion of the works herein contemplated as will be indicated by the Engineer, with the view to limit the total expenditure under this contract to the maximum above stated; and so soon as the said maximum amount will be expended, this contract will then be considered as ended, and the Contractor will not thereafter be entitled to continue the works under this contract, or to receive any further payment beyond the said maximum amount, unless the Minister should authorize and direct further expenditure; in which case, it is understood that the Minister will have the right (which is hereby expressly reserved) to direct that any works, which may then remain to be done, shall be executed under this contract; and the Contractor hereby agree to execute the same at the rates or prices hereinafter mentioned, as if these remaining works formed part of this contract. Provided also, that in case the said works, on completion, by reason of alterations, variations, deviations, diminutions, omissions, or otherwise, should not amount to the total sum above mentioned, the Contractor will not be entitled to the payment of the difference in cost, whatsoever the same may be. No compensation shall, in any case, be claimable by the Contractor for any loss of anticipated profits.

**Engineer to be sole judge of work, material, etc.**

8. That the Engineer shall be the sole judge of work and material in respect of both quantity and quality, and his decision on all questions in dispute with regard to work or material, or as to the meaning or intention of this contract and the plans, specifications and drawings shall be final, and no works or extra or additional works or changes shall be deemed to have been executed, nor shall the Contractor be entitled to payment for the same, unless the same shall have been executed to the satisfaction of the Engineer, as evidenced by his certificate in writing, which certificate shall be a condition precedent to the right of the Contractor to be paid therefor.

**Schedule of prices.**

9. It is hereby distinctly understood and agreed, that the respective portions of the works set out or referred to in the list or schedule of prices to be paid for the different kinds of work, include not merely the particular kind of work or materials mentioned in said list or schedule, but also all and every kind of work, labor, tools and plant, materials, articles and things whatsoever necessary for the full execution and completing ready for use of the respective portions of the works to the satisfaction of the Engineer. And in case of dispute as to what work, labor, materials, tools and plant are or are not so included, the decision of the Engineer shall be final and conclusive.

**Foreman.**

10. A competent foreman is to be kept on the ground by the Contractor during all the working hours, to receive the orders of the Engineer, and should the person so appointed be deemed by the Engineer incompetent, or conduct himself improperly, he may be discharged by the Engineer, and another shall at once be appointed in his stead; such foreman shall be considered as the lawful representative of the Contractor, and shall have full power to carry out all requisitions and instructions of the said Engineer.

**Unsuitable material or imperfect work.**

11. In case any material, or other things in the opinion of the Engineer not in accordance with the said several parts of this contract, or not sufficiently sound or otherwise unsuitable for the respective works, be used for or brought to the intended works, or any part thereof, or in case any work be improperly executed, the Engineer may require the Contractor to remove the same, and to provide proper material or other things, or properly re-execute the work, as the case may be, and thereupon the Contractor shall and will immediately comply with the said requisition, and if twenty-four hours shall elapse and such requisition shall not have been complied with, the Engineer may cause such material, or other things, or such work to be removed; and in any such case the Contractor shall pay to Her Majesty all such damages and expense as shall be incurred in the removal of such material, materials, or other things, or of such work; or Her Majesty may, in her discretion, retain and deduct such damages and expenses from any amounts payable to the Contractor.

All plant and material to become property of Her Majesty.

12. All machinery and other plant, materials and things whatsoever, provided by the Contractor for the works hereby contracted for, and not rejected under the provisions of the last preceding clause, shall from the time of their being so provided become, and until the final completion of the said works, shall be the property of Her Majesty for the purposes of the said works, and the same shall on no account be taken away, or used or disposed of except for the purposes of the said works, without the consent in writing of the Engineer, and Her Majesty shall not be answerable for any loss or damage whatsoever which may happen to such machinery or other plant, material or things, provided always that upon the completion of the works and upon payment by the Contractor of all such moneys, if any, as shall be due from to Her Majesty such of the said machinery and other plant, material and things as shall not have been used and converted in the works, and shall remain undisposed of, shall, upon demand, be delivered up to the Contractor.

Insufficient machinery.

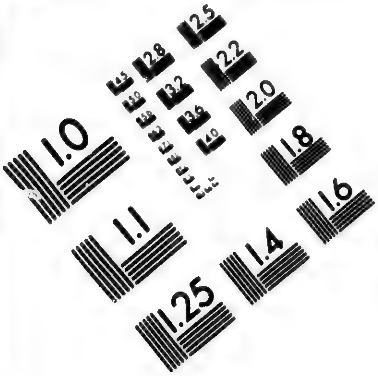
Material or labor to be increased.

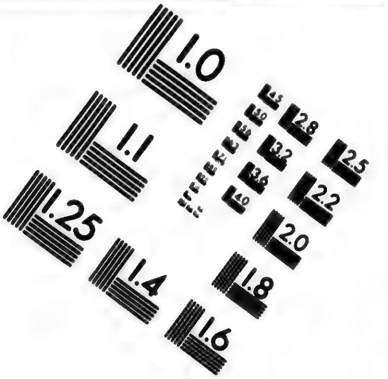
13. If the Engineer shall at any time consider the number of workmen, horses, or quantity of machinery or other plant, or the quantity of proper materials, respectively employed or provided by the Contractor on or for the said works, to be insufficient for the advancement thereof towards completion within the limited times, or that the works are, or some part thereof is not being carried on with due diligence, then in every such case the said Engineer may, by written notice to the Contractor, require to employ or provide such additional workmen, horses, machinery or other plant, or materials, as the Engineer may think necessary, and in case the Contractor shall not thereupon within three days, or such other longer period as may be fixed by any such notice, in all respects comply therewith, then the Engineer may, either on behalf of Her Majesty, or if he see fit, may, as the agent of and on account of the Contractor, but in either case at the expense of the Contractor, provide and employ such additional workmen, horses, machinery and other plant, or any thereof or such additional and materials respectively, as he may think proper, and may pay such additional workmen such wages, and for such additional horses, machinery or other plant, and materials respectively, such prices as he may think proper, and all such wages and prices respectively, shall thereupon at once be repaid by the Contractor, or the same may be retained and deducted out of any moneys at any time payable to the Contractor; and Her Majesty may use, in the execution or advancement of the said work not only the horses, machinery, and other plant, and materials so in any case provided by anyone on Her behalf, but also all such as may have been or may be provided by or on behalf of the said Contractor.

Delay in execution.

Work may be taken out of the Contractor's hands.

14. In case the Contractor shall make default or delay in diligently continuing to execute or advance the works to the satisfaction of the Engineer, and such default or delay shall continue for six days after notice in writing shall have been given by the Engineer to the Contractor requiring to put an end to such default or delay, or in case the Contractor shall become insolvent, or make an assignment for the benefit of creditors, or neglect either personally or by a skilful and competent agent to superintend the works, then in any of such cases Her Majesty may take the work out of the Contractor's hands and employ such means as She may see fit to complete the work, and in such cases the Contractor shall have no claim for any further payment in respect of the works performed, but shall nevertheless remain liable for all loss and damage which may be suffered by Her Majesty by reason of the non-completion by the Contractor of the works; and all materials and things whatsoever, and all horses, machinery and other plant provided by for the purpose of the works, shall remain and be considered as the property of Her Majesty for the purposes and according to the provisions said conditions contained in the twelfth clause hereof.





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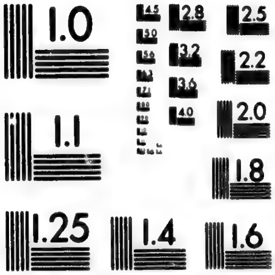

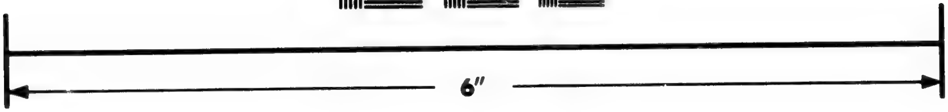

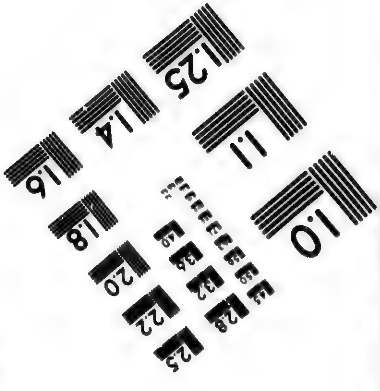

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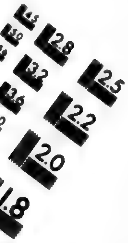
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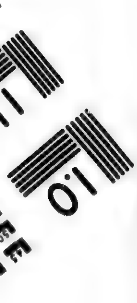
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**Contractor to take risk of all loss or damage.**

15. The Contractor shall be at the risk of, and shall bear, all loss or damage whatsoever, from whatsoever cause arising, which may occur to the works, or any of them, until the same be fully and finally completed and delivered up to and accepted by the said Minister of Public Works for the time being; and if any such loss or damage occur before such final completion, delivery and acceptance, the Contractor shall immediately at own expense repair, restore and re-execute the work so damaged, so that the whole works, or the respective parts thereof, may be completed within the time hereby limited.

**Contractor to have no claim for delay.**

16. The Contractor shall not have or make any claim or demand, or bring any action or suit or petition against Her Majesty for any damage which may sustain by reason of any delay in the progress of the work, arising from the acts of any of Her Majesty's agents, and it is agreed that in the event of any such delay the Contractor shall have such further time for the completion of the works as may be fixed in that behalf by the Minister of Public Works for the time being.

**Contractor not to make assignment.**

17. The Contractor shall not make any assignment of this contract, or any sub-contract, for the execution of any of the works hereby contracted for; and in any event no such assignment or sub-contract, even though consented to, shall exonerate the Contractor from liability, under this contract, for the due performance of all the work hereby contracted for. In the event of any such assignment or sub-contract being made, then the Contractor shall not have or make any claim or demand upon Her Majesty for any future payments under this contract for any further or greater sum or sums than the sum or sums respectively at which the work or works so assigned or sub-contracted for shall have been undertaken to be executed by the assignee or sub-contractor; and in the event of any such assignment or sub-contract being made without such consent, Her Majesty may take the work out of the Contractor's hands, and employ such means as she may see fit to complete the same; and, in such case, the Contractor shall have no claim for any further payment in respect of the works performed, but shall, nevertheless, remain liable for all loss and damage which may be suffered by Her Majesty by reason of the non-completion by the Contractor of the works; and all materials and things whatsoever, and all horses, machinery, and other plant provided by for the purposes of the works, shall remain and be considered as the property of Her Majesty for the purposes and according to the provisions and conditions contained in the twelfth clause hereof.

**Work may be taken out of the Contractor's hands.**

18. Time shall be deemed to be of the essence of this contract.

**Contractor responsible for damage.**

19. The Contractor shall be responsible for all damages claimable by any person or corporation whatsoever, in respect of any injury to persons or to lands, buildings, ships or other property, or in respect of any infringement of any right whatsoever, occasioned by the performance of the said works, or by any neglect or misfeasance or non-misfeasance on part, and shall and will at own expense, make such temporary provisions as may be necessary for the protection of persons, or of lands, buildings, ships or other property, or for the uninterrupted enjoyment of all rights of persons, or corporations, in and during the performance of the said works.

**Failing to pay salaries or wages.**

20. If the Contractor fail at any time in paying the salaries or wages of any person employed by upon or in respect of the said works, or any of them, and any part of such salary be one month in arrear, or if there be due to any such person one month's wages or salary, the Engineer may notify the Contractor to pay such salary or wages, and if two days elapse and the

same be not paid in full up to the date of payment or to such other date as may be in accordance with the terms of employment of such person, then Her Majesty may pay to such person salary or wages from any date to any date, and to any amount which may be payable, and may charge the same to the Contractor , and the Contractor covenant with Her Majesty to repay at once any and every sum so paid.

**Stakes and marks to be protected.** 21. The Contractor will protect and will not remove or destroy, or permit to be removed or destroyed, the stakes, buoys and other marks placed on or about the said works by the Engineers of the works, and shall furnish the necessary assistance to correct or replace any stake or mark which, through any cause, may have been removed or destroyed.

**Contractor's address.** 22. Any notice or other communication mentioned in this contract to be notified or given to the Contractor shall be deemed to be well and sufficiently notified or given, if the same be left at the Contractor office or mailed in any Post Office, to the Contractor or foreman, addressed to the address mentioned in this contract, or to the Contractor last known place of business.

**Schedule of prices.** 23. And Her Majesty, in consideration of the premises, hereby covenants with the Contractor , that will be paid for and in respect of the works hereby contracted for, and in the manner set out in the next clause hereof the several prices or sums following, viz.:

* * * * *

* * * * *

**Payments.** 24. Cash payments equal to about ninety per cent. of the value of the work done, approximately made up from returns of progress measurements and computed at the prices agreed upon or determined under the provisions of this contract, will be made to the Contractor monthly on the written certificate of the Engineer that the work for or on account of which the certificate is granted, has been duly executed to his satisfaction and stating the value of such work computed as above mentioned—and upon approval of such certificate by the Minister of Public Works, for the time being, for the Dominion of Canada, and the said certificate and such approval thereof shall be a condition precedent to the right of the Contractor to be paid the said ninety per cent. or any part thereof. The remaining ten per cent. shall be retained until the final completion of the whole work to the satisfaction of the Chief Engineer, for the time being, having control over the work, and within two months after such completion the remaining ten per cent. will be paid. And it is hereby declared that the written certificate of the said Engineer certifying to the final completion of said works to his satisfaction shall be a condition precedent to the right of the Contractor to receive or be paid the said remaining ten per cent., or any part thereof.

**Monthly estimates.** 25. It is intended that every allowance to which the Contractor fairly entitled, will be embraced in the Engineer's monthly certificates; but should the Contractor at any time have claims of any description which consider are not included in the progress certificates, it will be necessary for to make and repeat such claims in writing to the Engineer, within fourteen days after the date of each and every certificate in which allege such claims to have been omitted.

**Claims by Contractors.** 26. The Contractor, in presenting claims of the kind referred to in the last clause, must accompany them with satisfactory evidence of their accuracy, and the reason why think they should be allowed. Unless such claims are thus made during the progress of the work, within fourteen days, as in the preceding clause, and repeated, in writing, every month, until finally adjusted or rejected, it must be clearly understood that they shall be forever shut out, and the Contractor shall have no claim on Her Majesty in respect thereof.

**Progress measurements.**

27. The progress measurements and progress certificates shall not in any respect be taken as an acceptance of the work or release of the Contractor from responsibility in respect thereof, but shall at the conclusion of the work deliver over the same in good order, according to the true intent and meaning of this contract.

**Operations may be suspended.**

28. Her Majesty shall have the right to suspend operations from time to time at any particular point or points or upon the whole of the works, and in the event of such right being exercised so as to cause any delay to the Contractor , then an extension of time equal to such delay or detention, to be fixed by the Minister of Public Works, as above provided for, shall be allowed to complete the contract, but no such delay shall vitiate or avoid this contract or any part thereof or the obligation hereby imposed or any concurrent or other bond or security for the performance of this contract, nor shall the Contractor be entitled to any claim for damages by reason of any such suspension of operations. And at any time after operations have been suspended either in whole or part—such operations may be again resumed and again suspended and resumed as Her Majesty may think proper. And upon the Contractor receiving written notice on behalf of Her Majesty that the suspended operations are to be resumed, the Contractor shall at once resume the operations and diligently carry on the same.

**Resumed.**

**Appropriation by Parliament.**

29. Should the amount now voted by Parliament and applicable towards payment for the work hereby contracted for, be at any time expended previous to the completion of the works, the Minister of Public Works for the time being, may give the Contractor written notice to that effect. And upon receiving such notice the Contractor may, if think fit, stop the work—but in any case shall not be entitled to any payment for work done, beyond the amount voted and applicable as aforesaid—unless and until the necessary funds shall have been voted by Parliament in that behalf. And in no event shall the Contractor have or make any claim upon Her Majesty for any damages or compensation by reason of the said suspension of payment, or by reason of any delay or loss caused by the stoppage of work.

**Spirituous liquors.**

30. The Contractor shall not permit, allow, or encourage the sale of any spirituous liquors on or near the works.

**No Sunday labour.**

31. No work whatever shall at any time or place be carried on during Sunday, and the Contractor shall take all necessary steps for preventing any foreman, or agent, or men from working or employing others on that day.

**Chief Engineer to be arbitrator.**

32. It is hereby agreed, that all matters of difference arising between the parties hereto, upon any matter connected with or arising out of this contract, the decision whereof is not hereby especially given to the Engineer,—shall be referred to the award and arbitration of the Chief Engineer, for the time being, having control over the works, and the award of such Engineer, shall be final and conclusive ; and it is hereby declared that such award shall be a condition precedent to the right of the Contractor to receive or be paid any sum or sums on account, or by reason of such matters in difference.

33. It is distinctly declared that no implied contract of any kind whatsoever, by or on behalf of Her Majesty, shall arise or be implied from anything in this contract contained, or from any position or situation of the parties at any time, it being clearly understood and agreed that the express contracts, covenants and agreements herein contained and made by Her Majesty, are and shall be the only contracts, covenants and agreements upon which any rights against Her are to be founded.

34. This contract is hereby, pursuant to the provisions of the 8th section of the Statute, 41st Victoria (1878), chapter 5, made subject to the express condition that no member of the House of Commons of Canada shall be admitted to any share or part of such contract, or to any benefit to arise therefrom.

Contract may be cancelled.

35. In the event of it becoming advisable in the interests of the public to suspend the work hereby contracted for, or any portion thereof, at any time before its completion, and to put an end to this contract, the Minister of Public Works of Canada for the time being shall have full power to stop the work and to cancel this contract, on giving due notice to that effect to the Contractor . The Contractor , however, will be entitled to receive payment for all sums then due for work already done, materials used or delivered, or ready to be used, or in course of preparation, together with such reasonable compensation as will cover all *bonâ fide* damages, if any, resulting therefrom, and as may then be agreed upon; or, in case of disagreement, as may be determined by the official Arbitrators of the Dominion of Canada; it being understood, however, that no compensation will be allowed to or claimed by the Contractor for materials procured for the works, after the date of the service of the notice above referred to, or for any loss of anticipated profits, either in respect of the works so suspended as aforesaid, or of the materials then procured for said works.

In Witness whereof, the Contractor ha hereto set hand and seal and these presents have been signed and sealed by the said Minister, and countersigned by the Secretary of the Department of Public Works of Canada, on behalf of Her Majesty.

Signed, sealed and delivered by the Contractor in presence of

Signed, sealed and delivered by the Minister, and countersigned by the Secretary of Public Works in the presence of

## A

## GENERAL SPECIFICATION DATED 30TH NOVEMBER, 1878,

### FOR THE CONSTRUCTION OF THE WORK.

*Referred to and declared to form part of the Contract.*

Works to be covered by Contract.

1. This specification refers to all works of construction and materials required in making and building the railway up to *formation level*, and preparing it for the permanent way; comprising clearing, close cutting, grubbing, fencing, excavation, tunnelling, draining, ditching, foundation works, bridges, culverts; also tracklaying, ballasting, and all other works connected with the construction and completion of the line of railway, to which the Engineer may consider this specification to be applicable under each contract.

### CLEARING, ETC.

Clearing included in Contract for Telegraph.

2. The clearing is embraced in the contract for the erection of the telegraph; but in the event of any clearing remaining to be executed, the Contractor for grading may be required and directed to do it; a price for clearing is therefore necessary.

**Width of clearing.** 3. Where the railway passes through wooded sections, the land must be cleared to the width of sixty-six feet on each side of the centre line, or such greater or lesser width as the Engineer may direct.

**Clearing.** 4. The clearing is to be done so that all the brush, logs and other loose material within its limits shall be burned. In no case shall any of the brush or logs be cast back upon the adjacent timber lands; they must invariably be made into piles near the centre of the space to be cleared, and there entirely consumed. All brush or trees accidentally or otherwise thrown into the adjacent woods, must be dragged out and burned. The land when burned must be left in a clean condition.

**Close Cutting.** 5. Where embankments are to be formed less than four feet or more than two feet in height, all the standing timber and stumps must be chopped close to the ground within the limits of the embankment, and burned.

**Grubbing.** 6. Where excavations will not exceed three feet in depth, or embankments two feet in height, all stumps must be grubbed out, and if possible, burnt; those that will not burn must be carried beyond the limits of the cuttings and embankments, where directed, and there piled. Directions will be given at the proper time, as to the extent of ground required to be cleared, close cut and grubbed. The side ditching and off-take drains must also be grubbed, but no grubbing will be paid for in borrowing pits.

## FENCING.

**Fencing** 7. The fence, wherever required, shall be a strong, well-built, heavy farm fence of approved design, thoroughly secured by stakes, riders, posts and yokes, or other means to prevent its removal by gales of wind or animals.

**Gates.** 8. The farm gates, when required, will be light and strong, of an approved design, similar to those on the Intercolonial Railway.

**Fencing through cleared land.** 9. The fencing to be thoroughly completed through all the cleared lands and wherever it may be directed to be placed by the Engineer.

## GRADING.

**Time of commencement.** 10. In woodland the grading will be commenced after the clearing, close cutting and grubbing required is completed to the satisfaction of the Engineer, and the Contractor will be held responsible for all damage to crops.

**Widths and slopes.** 11. The width of embankments at sub-grade or formation level will be 17 feet. The width of cuttings will not be less than 22 feet. The slopes of earth-work will be made one and a-half horizontal to one perpendicular. In rock cuttings the slopes will be, as a rule, one horizontal to four perpendicular. In cuttings partly earth and partly rock, a berm of six feet shall be left on the surface of the rock. The widths, slopes and other dimensions above defined may be varied by the Engineer at any time, to suit circumstances. And the contractor shall not take out or be paid for rock, nor any other excavation beyond the slopes, without an express order, in writing, from the Engineer. In the event of a slide in a rock cutting after it is formed, the Contractor will remove the *debris*, and be paid for it as loose rock or as earth, according to the class to which it may appear to the Engineer to belong.

**Removing slides.**

**Materials in embankments.**

12. The material to be placed in the embankments must be approved by the Engineer, and in places where the natural surface of the ground upon which the embankment is to rest is covered with vegetable matter, which cannot be burned off in clearing, and which would, in the opinion of the Engineer, impair the work, the same must be removed to his entire satisfaction. In the event of the line crossing muskegs or morasses, it may be deemed by the Engineer expedient that a platform of logs shall be formed under the embankment, of such width as will extend through and to about six feet beyond the side slopes, and of such depth as may be required, according to the height of embankment. The logs to range from 6 inches to 15 inches diameter, and must be laid close together and covered with brush. All sloping ground covered with pasture shall be deeply ploughed over the base of the embankments before the latter are commenced.

**Logging across muskegs**

**Sloping Ground.**

**Off-take ditches.**

13. In level prairie sections it will be necessary to excavate off take ditches considerable distances to the right or left of the line. These ditches will generally be required in the lowest ground, where the material is frequently of a tough nature (locally known by the name of "Gumbo"). These off-take ditches must be of such widths and depths as may be required and directed. The sides shall be sloped one vertical to two horizontal, and the material shall be cast out so as to leave a berm of at least six feet between the deposit and the top of the slopes. A separate price for off-take ditches will be required in the tenders, and the quantities shall embrace all excavation in connection therewith, beyond the limits of the railway land.

**"Gumbo."**

**Under-drains.**

14. Side-hill ground to be covered by embankment shall first be thoroughly under-drained as the Engineer may see expedient, and all cuttings after being formed, and all slopes likely to be affected by wet must be similiarly under-drained, longitudinally or transversely, or both, as circumstances may seem to him to require. These drains will be constructed in a similar way to that in which ordinary land drains are sometimes made; a trench will first be dug to a minimum depth of four feet, and in the bottom of this trench, four or five cedar or spruce poles about two inches in diameter will first be laid by hand, breaking joint; over the poles will then be placed not less than three feet of small broken stone, not larger than ordinary road metal or good gravel ballast, over which will be deposited such material convenient to the place as the Engineer may approve of. The Contractor must find all the material required in these drains, do all the work described, and remove the surplus earth. These drains must always be made with a sufficient longitudinal fall for the easy flow of the water, and therefore they may in level cuttings be deeper at one end than at the other, but the minimum depth will be not less then four feet.

**Side ditches.**

15. On the completion of the cuttings and the under-drains provided for in last clause, ditches for the removal of surface water shall be formed along each side at the bottom of the slopes, according to directions to be given. Catch-water ditches shall also be formed some distance back from the top of the slopes, to exclude from the excavation any water flowing from the adjoining lands; the Contractor shall also construct all other drains and ditches which the Engineer may deem necessary for the perfect drainage of the Railway and works.

**Catchwater ditches**

**Cuttings, ditches, roads, etc.**

16. All open ditches in cuttings or elsewhere, other than those referred to in clause 13, and all excavations required for turning, making or changing water courses, and which must be executed as may from time to time be directed, will be measured up and paid for as excavation according to its class, and all other excavations such as may be required in the formation of public roads, or in borrowing pits, or in grading depot grounds, turnouts or branches, and

**Excavations in foundations.**

so much of ordinary foundation pits for bridges and culverts as are not under the level of the water, shall be considered as a necessary part of the excavation for the formation of the roadway, and must be executed and the material deposited according to the directions of the Engineer, and will be paid for at the same rate per yard as the ordinary excavation, according to its denomination. In ordinary foundation pits, where pumping or baling becomes necessary, all the excavation under water level shall be measured and reckoned *at three times the price of earth excavation* in order to cover the extra cost involved.

**Excavations.** 17. Excavation will be classed under three heads, viz.: Solid Rock, Loose Rock and Earth, and will be paid for according to the following definitions:

**Solid rock excavations.** 1st. All stones and boulders measuring more than 27 cubic feet, and all solid quarry rock, shall be termed Solid Rock Excavation.

**Loose rock excavations.** 2nd. All large stones and boulders measuring less than 27 cubic feet, and all loose rock whether *in situ* or otherwise, that may be removed with facility by hand, pick or bar, without the necessity of blasting, shall be termed Loose Rock Excavation.

**Earth excavation.** 3rd. All other excavation of whatever kind, with the exception of off-take ditches referred to in clause 13, shall be termed Earth Excavation.

**Haul.** 18. The contract price for these several classes of excavation shall be taken to include the whole cost of hauling, except only extreme cases which may involve a haul of more than twelve hundred feet. For every hundred feet of haul over twelve hundred feet and up to twenty-five hundred feet, the Contractor will be allowed at the rate of one cent per cubic yard, that is to say: in the event of the haul being in any case twenty-five hundred feet, thirteen cents per yard shall be added to the schedule rate, which will be the maximum allowance per haul in any case. This clause shall not apply to ballast.

**Embankments and cuttings.** 19. The embankments must be made to such sufficient height and width as will allow for the subsidence of the same, and both cuttings and embankments shall be left at the completion of the contract, at such heights, levels, widths and forms as directed by the Engineer, the upper surface of the banks to be rounded in order to throw off the water.

**Rounding of Railway.** 20. The whole of the grading shall be carefully formed to the levels given, and the roadway in cuttings shall invariably be rounded and left from six to eight inches lower at the sides than on the centre line. In rock cuttings it will be sufficient to form a water channel about two feet wide and eight inches deep along each side. All materials found in excavations, whether in road-bed cuttings, ditches, water channels, road crossings, borrowing pits or elsewhere, must be deposited in such places as the Engineer may direct. In cases where the road-bed excavations are insufficient to form the embankments, the deficiency shall be supplied by widening the cuttings, or from the sides of the roads, or from borrowing pits, but no material shall be so supplied without his concurrence, and not until the cuttings are completed, without his express sanction. All borrowing pits shall, if required by the Engineer, be dressed to a good shape and properly drained. Where material to make up embankments is taken from the side, a berm of at least ten feet from bottom of slope of embankment shall remain untouched.

**Borrowing.**

**Wasting.** 21. Where the excavation in a cutting exceeds what may be required to make the embankments of the specified width, the Engineer may direct that the embankments be increased in width with the surplus material, and when this is done to his satisfaction, the remainder, if any, may be wasted; but in every case where either borrowing or wasting is resorted to, the materials must be taken and deposited as he may regulate and direct.

**Building materials in excavations.** 22. In case where pitching or rip-rapping will be required for the protection of embankments contiguous to streams, all stone suitable for this work found in excavations may be removed and deposited in some convenient place until required, and all good building stone which may be found in rock excavations may, with the approval of the Engineer, be preserved and piled along the side of the line as directed. But any material so found and used will not be paid for twice, the quantity, if considerable, will form a deduction from the quantity of excavation as measured in the cutting.

**Rip-rap.** 23. Rip-rap work, whenever required and ordered for the protection of slopes of embankments, must be well and carefully performed, in such manner and of such thickness as may be directed. It will be measured and paid for by the cubic yard.

**Service roads.** 24. Roads constructed to and from any point on the line of railway for the convenience of the Contractor, for the conveyance of material or otherwise, must be at his own risk, cost and charges, but the Contractor **Land.** will not be required to purchase land for the railway track, for branches or for borrowing pits.

**Road crossings.** 25. Wherever the line is intersected by public or private roads, the Contractor must keep open at his own cost convenient passing places, and he shall be held responsible for keeping all crossings, during the progress of the works, in such conditions as will enable the public to use them with perfect safety, and such as will give rise to no just ground for complaint. Contractors will be held liable for any damages resulting from negligence on their part or that of their men. At all public roads crossed on the level, the Contractor will be required to put in two substantial cattle-guards of wood of such dimensions as may be directed by the Engineer.

**Ballast.** 26. Whenever any material is met with in the excavations, which the Engineer shall consider suitable and required for ballast, the same shall, at his discretion, be reserved for that purpose.

**Slips.** 27. When slips occur in cuttings, after they are properly formed, the material must be immediately removed by the Contractor, the slopes re-formed, and such precautions adopted as the Engineer may deem necessary. The Contractor will be paid for the removal of slips as already provided for.

**Working in winter.** 28. In the event of earth excavation being proceeded with in winter, no snow or ice must be placed in embankments, or allowed to be covered up in them, and all frozen earth must, as far as practicable, be excluded from the heart of embankments.

**Contractor to finish up cuttings, embankments, etc.** 29. The Contractor shall, before the work is finally accepted, finish up cuttings and embankments, dress and drain borrowing pits when required, dress slopes to the required angles, repair all damages by frost or other causes, and complete everything connected with the grading of the road-bed, bridging, etc., in a creditable and workmanlike manner, in accordance with the directions and to the satisfaction of the Engineer.

**Measurement in excavation.** 30. The measurement of quantities shall invariably be made in excavation, unless in special cases, if any, where this may be found impossible; in such cases the Engineer shall determine the quantities in embankment, after making all proper allowances, of which he shall be the judge.

**Price to cover every contingency.** 31. The prices stipulated for excavation of the several denominations, together with the price for haul in extreme cases, and the price for work in foundation pits under water level, shall be the total prices for excavating, loading, removing and depositing all the material. In a word, the rates and prices stipulated in the contract must be understood to cover every contingency; the furnishing of all labor, material, power and plant; the cost of finishing up cuttings and embankments, the dressing and draining of borrowing pits, when required; the dressing of slopes to the required angle, and the completing of everything connected with the grading of road-bed, in a creditable and workmanlike manner, in accordance with the directions and to the satisfaction of the Engineer.

### TUNNELLING.

**"Line Tunnels and "Stream Tunnels."** 32. The tunnelling will consist of "Line Tunnels" and "Stream Tunnels;" the former shall be formed to an exact minimum section hereafter to be furnished. For the purpose of tendering, the sectional area of "Line Tunnels" shall be calculated at 405 superficial feet, equal to 15 cubic yards to the lineal foot of tunnel. The "Stream Tunnels," where formed, shall be driven through the solid rock which, in some places, forms the sides of ravines, they must be formed in the manner to be pointed out in each case. Open cuttings at the end will be excavated, to give an easy flow to the water; these open cuttings may be slightly curved, but the tunnels proper must be perfectly straight from end to end, with the sides as smooth as practicable. The up-stream end in each tunnel must generally be one foot lower than the bed of the stream opposite, and they must be driven with a proper inclination. Care must be taken to leave a solid pillar of rock between the tunnel and the side of the ravine, equal (except in special cases) to not less than about double the diameter of the tunnel. The thickness of solid rock over the tunnel shall be similarly proportioned. The open cuttings which form the outlets and inlets of tunnels shall be measured and paid as ordinary excavation, according to classification, the material excavated from them to be placed in the embankments or as may be directed. The tunnels shall be paid for by the lineal foot, and the price must cover all cost of pumping, baling, draining, &c., which may be necessary. The tunnels required will be of the following dimensions:—

| Sectional areas. | | | | | Lineal foot of Tunnel. | |
|---|---|---|---|---|---|---|
| Twenty-feet | Tunnels, | 324 | superficial | feet equals | 12 | cubic yards. |
| Sixteen " | do | 216 | " | " | 8 | " |
| Twelve " | do | 108 | " | " | 4 | " |
| Eight " | do | 54 | " | " | 2 | " |
| Six " | do | 27 | " | " | 1 | " |

### TIMBER STRUCTURES.

33. The structures for the passage of small streams may be built of the most suitable wood to be found in the country. Character and quality to be approved by the Engineer. The several structures are intended to be built according to the following specification and the drawings referred to; but the character of the designs may be changed to suit circumstances.

**General drawings.** 34. General drawings No. 1 to 9, inclusive, show the kind of structures to be erected for the passage of the smaller streams under the railway.

| | | | | |
|---|---|---|---|---|
| Drawing | No. 1, | for embankments | 2 | feet high. |
| " | No. 2, | " | 4 | " |
| " | No. 3, | " | 6 | " |
| " | No. 4, | " | 8 | " |
| " | No. 5, | " | 10 | " |
| " | No. 6, | " | 15 | " |
| " | No. 7, | " | 20 | " |
| " | No. 8, | " | 25 | " |
| " | No. 9, | " | 30 | " |

**General drawing, No. 1.** 35. No. 1 will be composed of two bents framed together in the manner shown in the drawing, having caps and mud sills framed into posts and braces, and pinned as shown. These bents will be placed in trenches —previously excavated—11 feet centre to centre, and at least 5 feet in the ground, and when properly levelled as to grade, height, &c., the earth will then be firmly packed around them. These bents will be spanned by stringers 16 inches by 12 inches, and bolted by $\frac{7}{8}$ inch bolts—with washers—to the caps. The bank stringers will be 12 inches by 12 inches. The whole then covered by ties 9 inches by 8 inches, and of the lengths shown on the plan.

**General drawing, No. 2.** 36. No. 2 will be similar in every respect to No. 1, except as to height of bents. See drawing.

**General drawing, No. 3.** 37. No. 3 will be composed of four bents; each bent will have cap and mud-sill 12 inches by 12 inches, and four posts 12 inches by 12 inches, and two braces 12 inches by 12 inches, all framed together and pinned in the manner shewn. There will be two diagonal braces of 9 inches by 6 inches placed in each bent in the manner shown, and bolted to the frames by $\frac{7}{8}$ inch bolts, with washers under the heads and nuts of bolts, seven bolts to each brace. Trenches will be dug for the reception of these bents 11 feet centre to centre, and 5 feet deep, and when the bents have been levelled up to grade height and placed in line, the earth will then be tamped firmly round them. Stringers of 16 inches by 12 inches must be provided and bolted to cap by $\frac{7}{8}$ inch iron bolts with washers. The bank stringers will be 12 inches by 12 inches; the whole structure will then be covered with special ties 9 inches by 8 inches as shown.

**General drawings, Nos. 4 to 9.** 38. Nos. 4 to 9 will be similar to No. 3 already described. No. 6 will have six bents, No. 7 eight bents, No. 8 eight bents, and No. 9 ten bents, and they will increase in height according to the height of the bank. In cases where stringers cannot be procured long enough to span the entire number of bents, as in the cases of Nos. 6, 7, 8 and 9, then the stringers may be joined either by butt-joint or corbels resting on caps or be allowed to overlap each other on caps, all being firmly bolted to caps.

**Trestle-work.** 39. Wherever the circumstances of the case require the adoption of Trestle Work in lieu of embankments, the same shall be erected in the most substantial manner in accordance with the plans and specifications of the same to be furnished from time to time by the Engineer.

**Pile bridges.** 40. Wherever the circumstances of the case require the adoption of Bridges on Piles, they will be erected according to the following or another approved plan. Trenches will first be excavated 21 feet centre to centre and to the depth of the beds of the streams. Each bent will be composed of 4 piles, driven perpendicularly, together with 2 spur piles, as shown in the drawing. The piles are to measure at the butt or larger end not less than 12 nor more than 17 inches in diameter, exclusive of bark. They must be perfectly sound and straight, and be of such lengths as circumstances may require. The piles must be driven by a hammer weighing 1,500 lbs. or upwards, until they reach perfectly firm ground. They will generally be tested by the hammer falling 30 feet at the last blow. Care must be taken to have them driven truly, so that the caps, waling pieces and braces may be properly framed and bolted to them. The spur piles must be curve-pointed, so that as they are driven they will gradually come into their places and butt against the piles and be bolted to the same, with two bolts to each spur pile. Before being driven the piles must be sawed or chopped off square at the butt, and tapered to a blunt point at the smaller end. Should there appear to be any danger of splitting, the heads must be bound with iron hoops, and if necessary the points must also be properly shod. The stringers must be double, 12 inches by 16 inches, bolted together and resting on corbels, and be bolted securely to corbels and caps. The stringers must be of as long lengths as possible, and to break joint alternately inside and out. The bank stringers will be 16 inches by 12 inches. The whole to be covered by special ties 9 inches by 8 inches as shown.

**Bridges.** 41. The Railway will be carried over the larger streams by bridges. The abutments and piers will, in some cases, be built of crib-work filled with stone. The cribs must be constructed in the most substantial manner of the most suitable timber to be found in the vicinity, outside timbers to be not less than 12 inches square, dove-tailed at the angles, and properly pinned with hardwood pins or rag-bolts of iron, as the Engineer may direct; the ties may be of suitable round timber, dove-tailed into face timbers and pinned. The sloping faces of the cutwaters to piers must be of square timber laid with one side in the line of the rake of the cutwater, and be dove-tailed at angles, the two faces of the cutwaters will then be sheathed with hardwood plank 3 inches thick, well fastened to the crib-work with spikes of rag-bolts. The whole of the abutments and piers to be finished in accordance with the plans and to the satisfaction of the Engineer.

**Abutments and piers of crib work.**

**Bridge superstructure of wood.** 42. Where the circumstances of the case require the adoption of timber bridges, their superstructure will be of the most improved Howe Truss pattern, built of pine, with white oak keys, cast-iron prisms and wrought-iron rods, with up-set ends, the whole to be first-class material and workmanship. Detail drawings will be prepared during the progress of the work, by the Engineer, to suit each span or bridge, and to which the Contractor must work. These bridges must be executed in a thoroughly substantial and workmanlike manner, and shall be completed in every respect, except painting, which will not be included in the present contract.

**Bridge superstructure of iron.** 43. The Government reserves the right to substitute and furnish iron superstructures for bridges in lieu of timber, and to take such steps as may be deemed best for placing the same in position. In the event of this right being exercised after the Contractor has incurred expense in procuring some of the timber, he shall not be entitled to any compensation on account of the substitution beyond the value of the material furnished and the labor expended thereon.

## FOUNDATIONS.

**Depth of pits. Coffer-dams.** 44. Foundation pits must be sunk to such depths as the Engineer may deem proper for the safety and permanency of the structure to be erected; they must in all cases be sunk to such depths as will prevent the structures being acted on by frost. The material excavated therefrom to be deposited in embankment, unless the Engineer directs otherwise. For ordinary foundation, the 16th clause is referred to. In the case of piers in large rivers or lakes, a special price must be given in the tenders for coffer-dams and all extra expense involved.

## MASONRY.

**Substitute masonry for timber work. General character.** 45. In order to prevent delay it will be expedient generally to build the structures in the first place of timber, but should it be practicable to insert structures of masonry at one or more places without interfering with the progress of the work, and it appears expedient to do so, the Engineer may be authorized to substitute masonry for wooden structures. In such cases the work must be of a substantial and permanent character, and in every respect equal to the best description of masonry in Railway works.

**When to be commenced.** 46. The masonry shall not be started at any point before the foundation has been properly prepared, nor until it has been examined and approved by the Engineer, nor until the Contractor has provided a sufficient quantity of proper materials and plant to enable the work to be proceeded with regularly and systematically.

**Stone.** 47. The stone used in all masonry on the line of railway, must be of a durable character, large, well proportioned and well adapted for the construction of substantial and permanent structures. Parties tendering must satisfy themselves as to where fitting material for the masonry can be most conveniently procured.

**Bridge masonry.** 48. *Bridge masonry* shall generally be in regular courses of large well-shaped stone, laid on their natural beds, the beds and vertical joints will be hammer-dressed, so as to form quarter-inch joints. The vertical joints will be dressed back square 9 inches, the beds will be dressed perfectly parallel throughout. The work will be left with the "quarry face" except the outside arrises, strings and coping, which will be chisel-dressed.

**Courses.** 49. The courses will not be less than twelve inches, and they will be arranged in preparing the plans to suit the nature of the quarries, courses may range up to 24 inches, and the thinnest courses invariably be placed towards the top of the work.

**Headers and stretchers.** 50. Headers will be built in every course not farther apart than 6 feet, they will have a length in line of wall of not less than 24 inches, and they must run back at least three times their height, unless when the wall will not allow this proportion, in which case they will pass through from front to back. Stretchers will have a minimum length in line of wall of 30 inches, and their breadth of bed will at least be 1½ times their height. The vertical joints in each course must be arranged so as to overlap those in the course below 10 inches at least. The above dimensions are for minimum courses of 12 inches, the proportion will be the same for thicker courses.

**Quoins.** 51. The quoins of abutments, piers, &c., shall be of the best and largest stones, and have chisel drafts properly tooled on the upright arris, from two to six inches wide, according to the size and character of the structure.

**Coping.** 52. Coping stones, string courses and cut-waters shall be neatly dressed in accordance with the plans and directions to be furnished during the progress of the work.

**Bed stones for girders.** 53. The bed stones for girders shall be the best description of sound stone, free from drys or flaws of any kind, they must be not less than 12 inches in depth for the smaller bridges, and eight feet superficial area on the bed. The larger bridges will require bed stones of proportionately greater weight; these stones shall be solidly and carefully placed in position, so that the bridge will sit fair on the middle of the stones.

**Backing and bond.** 54. The backing will consist of flat-bedded stone, well shaped, having an area of bed equal to four superficial feet or more. Except in high piers or abutments, two thicknesses of backing stone, but not more, will be allowed in each course, and their joints must not exceed that of the face work. In special cases, where deemed necessary by the Engineer, to insure stability, the backing shall be in one thickness; the beds must, if necessary, be scabbled off, so as to give a solid bearing. No pinning will be admitted. Between the backing and face stones there must be a good square joint, not exceeding one inch in width, and the face stones must be scabbled off to allow this. In walls over three feet in thickness, headers will be built in front and back alternately, and great care must be taken in the arrangement of the joints so as to give perfect bond.

**Culvert masonry. General description.**

55. *Culvert Masonry* shall be built of good, sound, large flat-bedded stones, laid in horizontal beds. It may be known as Random or broken coursed work. The stones employed in this class of masonry will generally be not less in area of bed then three superficial feet, nor less in thickness than eight inches, and they must be hammer dressed so as to give good beds with half-inch joints. In smaller structures, and in cases where stones of good size and thickness cannot be had, they may, if in other respects suitable, be admitted as thin as five inches. All stones must be laid in their natural beds.

**Headers and stretchers.**

56. Headers shall be built in the wall, from front and back alternately, at least one in every five feet in line of wall, and frequently in the rise of wall. In the smallest structures headers shall not be less than twenty-four inches in length, and the minimum bed allowed for stretchers shall be twelve inches. In the larger structures all stones must be heavier in proportion. Every attention must be paid to produce a perfect bond, and to give the whole a strong, neat, workmanlike finish.

**Coping and covering.**

57. Wing walls will generally be finished with steps, formed of sound, durable stone, and not less than from 10 to 12 inches thick, and 6 feet superficial area; other walls will be covered with coping of a similar thickness, and of seven feet or upwards, superficial area. These coverings will be neatly dressed when required, and as may be directed. The walls of the box culverts will be finished with stones the full thickness of wall, and the covers will be from 10 to 15 inches thick, according to the span; they must have a bearing of at least 12 inches on each wall, and they must be fitted sufficiently close together to prevent the earth from falling through.

**Arches, 10 feet span and upwards.**

58. *Arches of* 10 *feet span and upwards* will be constructed of stones cut so that when laid, their beds will radiate truly from the centre of the circle, the depth of stones will of course vary with the span, but will never exceed 30 inches, they must not be less in length than 27 inches and they must break joint 10 inches; their thickness on the soffit must be at least 9 inches, and it will be dressed to the circle. All the stones must be dressed to the full depth of bed so as to give truly radiated joints from $\frac{3}{16}$ to $\frac{1}{4}$ inch, they must be set without pinning of any kind and the end joints must be properly squared. Each stone to be full bedded in cement, and each course afterwards thoroughly grouted. The outer ring stones to be neatly worked with a chisel draft around their edges.

**Arches, 8 feet span and under.**

59. *Arches of* 8 *feet span and under* shall be constructed of suitable flat-bedded stones ranging according to the span from 16 to 24 inches deep and with a minimum length of from 16 to 24 inches, and 5 to 6 inches in thickness on the soffit; they must invariably extend through the entire thickness of the arch. Each stone to be well and closely fitted so as to give half inch joints and to break joints with its fellow 7 to 9 inches. The whole must be laid in thin mortar and each course must be well grouted immediately after being laid. The outer arch stones to be as nearly uniform in depth as possible, of large size and neatly incorporated with the perpendicular face of the masonry. The key stones to be 10 or 12 inches on the soffit, to have a chisel draft around their edges, and to project beyond the face of the wall 2 or 3 inches.

**Cement to be used.**

60. All arches shall be built in cement, and before being covered with earth or the centering removed they must be thoroughly flushed on the back, levelled up and rounded to a moderately even and smooth surface with the same material.

**Centering.**

61. Centres of arches must in all cases be well formed, of ample strength, securely placed in position, and in every respect to the satisfaction of the Engineer. The ribs must not be placed farther apart than three

feet in any case. The laggings shall be cut to a scantling of three inches square. The supports of centres shall be substantial and well constructed, and they must be provided with proper wedges for easing centres when required.

62. Structures having more than one arch shall be provided with as many centres as the Engineer may deem proper, and in no case shall the centres be struck without his sanction.

**Centering and scaffolding.** 63. Centering and scaffolding of all kinds shall be provided by the Contractor, and the cost included in the price for masonry.

**Paving.** 64. The bottoms of culverts will be paved with stones set on edge, to a moderately even face, packed solid, the interstices being also well packed. The paving will be from 12 to 16 inches deep.

**Dry Masonry.** 65. Masonry shall be formed *dry* or *laid in mortar* as circumstances may determine. In *dry* masonry special regard must be paid to the stone being massive and well proportioned.

**Mortar.** 66. Mortar shall be of Hydraulic lime or cement, and common lime.

**Cement.** 67. Hydraulic lime mortar will be used unless otherwise directed in building all masonry, from the foundations up to a line two feet above the ordinary level of the stream. It will be used also in turning arches, in laying girder beds, coping, covering of walls generally, in lipping and in pointing. The hydraulic lime or cement must be fresh ground, of the best brand, and it must be delivered on the ground, and kept till used, in good order. Before being used, satisfactory proof must be afforded the Engineer of its hydraulic properties, as no inferior cement will be allowed.

**Common lime.** 68. Common lime mortar must be made of the best common lime and will be employed in all masonry (except dry) where cement is not directed to be used.

**Mortar, how made.** 69. Both cement and lime must be thoroughly incorporated with approved proportions of clean large-grained sharp sand. The general proportions may be one part of lime to two parts of sand, but this may be varied according to the quality of the lime or cement. Mortar will be only made as required, and it must be prepared and used under the immediate direction and to the satisfaction of an Inspector, by the Contractor's men, failing which the Inspector may employ other men to prepare the mortar, and any expense incurred thereby shall be borne by the Contractor. Grout shall be formed by adding a sufficient quantity of water to well tempered and well proportioned mortar.

**Grouting.** 70. When mortar is used, every stone must be set in a full bed and beaten solid; the vertical joints must be flushed up solid, and every course must be perfectly level and thoroughly grouted.

**Lipping.** 71. In all walls built in common lime, the exposed faces will have a four-inch lapping of cement.

**Pointing and protection in winter.** 72. All masonry must be neatly and skilfully pointed, but if done out of season, or if from any other cause it may require repointing before the the expiration of the contract, the Contractor must make good and complete the same at his own cost. Work left unfinished in the autumn must be properly protected during the winter by the Contractor, at his risk and cost.

**Puddle wall.** 73. A puddle-wall, at least two feet thick, extending from end to end of the masonry, and from the bottom to the top must be made between the back of the dry masonry and the embankment.

**Punning and filling.** 74. After the masonry of a structure has been completed for a period of four or five weeks, the formation of the embankment around it may be proceeded with. The earth must be carefully punned in thin layers around the walls, and in this manner the filling must be carried up simultaneously on both sides. The Contractor must be extremely careful in forming the embankments around culverts and bridges, as he will be held liable for any damages to the structures that may arise. The punning must be carefully attended to, and the whole filling must invariably be done in uniform courses from the bottom to the top of the embankment, without loading one side of the masonry more than another.

## TRACK-LAYING AND BALLASTING.

75. The work of Track-laying and Ballasting will embrace all engines, cars, and plant, (unless otherwise provided in the contract), and all labor and tools required for loading, unloading and distributing rails, joint-fastenings, spikes, points and crossings, and sleepers or cross-ties; laying, lifting, centreing, lining and surfacing the track; also, for making roads to ballast pits and laying all service tracks; for getting, loading and unloading the ballast, placing the same in the road bed and trimming it up. At the close of the contract any engines and platform cars which may be considered by the Engineer fit for further use, may be transferred to the Government on the valuation of the Engineer.

**Material furnished by Government.** 76. The Government will furnish to the Contractor rails, joint fastenings, spikes, points and crossings, switch gear, and switch frames.

### TRACK-LAYING.

**Distribution of material.** 77. The rails, joint-fastenings, spikes, points, and crossings, switch gear and frames, will be delivered by the Government to the Contractor at places to be indicated, from whence they shall be distributed by the Contractor.

**Track-laying.** 78. Track-laying shall include the supplying, furnishing and laying plank, including spikes for the same, on public and private road crossings, distributing rails, rail fastenings, spikes, points and crossings, ties, laying the same on main track and sidings, and centreing, lining and surfacing. Track-laying will be paid for by the lineal mile of 5,280 feet.

**Gauge.** 79. The rails shall be laid to a gauge of 4 feet 8½ inches clear between the rails, and they shall be well and carefully fastened at the joints, which must be near as possible opposite each other and on the same tie; special care must be taken at points and crossings to have the rails laid to a tight gauge, the rails must be full spiked and on curves the outer rail shall be elevated (unless otherwise directed), according to the degree of curvature as follows, that is to say, on one degree curves 0.05 feet, on two degree curves 0.10 feet, on three degree curves 0.15 feet, and on four degree curves 0.20 feet. The rails shall be handled with great care, and before being run over by either engine or cars, shall be full sleepered and surfaced. Every precaution shall be taken to prevent them getting bent during the progress of the ballasting.

**Sleepers.** 80. The sleepers or cross-ties must be of approved sound timber, smoothly hewn, free from all score-hacks, and chopped or sawn square at the ends, 8 feet long, flatted on two opposite sides to a uniform thickness of six inches, the flatted surface being not less than six inches, on either side, at the small end. They must be placed as nearly as possible at uniform distances apart, and at right angles to the rails, in such a manner that about twenty-five per cent. of the length of the rail shall have a bearing upon the surface of the sleepers. "Joint sleepers" must have both an upper and under surface bearing, at their smallest end, of at least eight inches.

**Sleepers under separate contract.** 81. When the Sleepers are provided under a separate contract from the Track-laying and Ballasting, the Contractor for the latter shall take delivery of them, in the position and at the points in which they are received by the Government Inspectors.

**Sidings.** 82. The Contractors shall lay all sidings and put in all points and crossings complete, embracing wing and jack rails, head blocks, switch and signal frames, and gearing.

**Contractors responsible for materials furnished by Government.** 83. The Contractors shall remove from the track and straighten all bent and damaged rails, and make good all injuries done before the works are finally accepted; and further, they will be held responsible for all materials provided for them, and give a receipt for the same upon taking delivery.

### BALLASTING.

**Ballast pits.** 84. The land for ballast pits and approaches thereto will be furnished by the Government and approved by the Engineer. In selecting land for the purpose, a preference will always be given to those points where the best material can be procured, having due regard to the convenience of the Contractors. During the working of any pit, should the material be found unfit for ballasting, the Engineer shall have power to compel the Contractors to close such pits and open others.

**Distribution of ballast for one "lift."** 85. The surface of ballast pits shall be stripped of soil where such exists, and no material whatever shall be placed on the road-bed but good clean gravel, free from earth, clay, loam or loamy sand; no large stones shall be allowed. The maximum size of gravel must not be greater in diameter than three inches. In unloading the ballast, the train must be kept working to and fro so as to thoroughly mix the different qualities of ballast, until a sufficient quantity is deposited for the first "lift." The track must then be raised so that there will be an average depth of six inches beneath the sleepers, and the ballast must be well beaten and packed under and around them. As the raising proceeds, the end of the lift shall extend over not less than three rail lengths, and before trains are allowed to pass over the inclined portion of the track, it must be made sufficiently solid to prevent bending the rails, or twisting the rail-joints. After the lift, the track shall be centred, lined, topped, surfaced and trimmed off to a proper form and width.

**Full ballast.** 86. In the event of full ballasting being required, a second "lift" must be made, in the same manner and with the same precautions as required for the first "lift," in order to secure a uniform thickness of 12 inches under the sleepers. In wet cuttings the Engineer shall have power to direct a greater thickness of ballast, should it be deemed necessary.

87. Whenever the work is sufficiently advanced to admit of trains using the line for Public Traffic, it will be in the power of the Government to regulate the running of all trains, so as to ensure safety and interfere as little as possible with the traffic.

**Public and private road crossings.** 88. The Contractors shall keep all public and private road crossings in a safe and serviceable condition during the progress of the work, leaving them well and properly planked inside and outside of the rails, as may be directed by the Engineer, and gravelled to a depth of at least ten inches for a distance of fifty feet on both sides of the track.

**Completed track.** 89. The track shall be left by the Contractors with everything complete, and well surfaced. The ballast shall be dressed off to the form required, and the whole shall be executed according to the direction and to the approval of the Chief Engineer, or other officer duly appointed.

**Manner of payment.** 90. The Contractor shall be paid by the cubic yard for all ballast put into the track, the measurement to be made in the pit or excavation, and the price per cubic yard to cover the cost of laying tracks to the pit, stripping the ground, excavating, handling, hauling, putting the ballast on the road-bed, and neatly trimming it off to the proper form.

## MISCELLANEOUS.

**Day's labor work.** 91. If any work or service be required to be done, which, in the opinion of the Engineer, does not come within the class of work to be measured under the contract, he shall be at liberty to direct the Contractor to perform the same by day's labor, and the Contractor, when required by him, shall supply such force as the Engineer may direct, and the Contractor shall perform such work, and he shall be paid the reasonable and actual wages of such force as ascertained by time-keeper and pay-sheet, together with fifteen per cent. for the use of tools and profit. The Engineer shall be at liberty to discharge any bad or unsuitable workmen who may be placed at day's labor work, and the work so performed shall be subject to his approval before payment thereof.

**Acceptance of tenders.** 92. No Tender will be entertained unless on one of the printed forms prepared for the purpose, and with the Schedule of Quantities therein correctly priced and accurately moneyed out; nor unless an accepted Bank Cheque, or other available security of such amount as may be required, accompanies the Tender, which shall be forfeited if the party and sureties tendering decline or fail to enter into the Contract for the works and Sureties' Indenture when called upon to do so, upon the tender being accepted. In the event of a tender not being accepted, the Cheque or other security will be returned.

**Deposit.** 93. For the due fulfilment of the contract, satisfactory security will be required, either by deposit of money, or its equivalent value at current rates of public securities, or bank stock, to the amount of five per cent. on the bulk sum of the contract, of which the sum sent in with the Tender will be considered a part, or by such other security as the Minister of Public Works, for the time being, of the Dominion of Canada, may approve of; and all costs and expenses incurred in respect of any security offered by the Contractor, whether in investigating the title of same, preparing instruments, obtaining valuation or otherwise, shall be paid by the Contractor, whether such security be approved of or not.

**Sureties.** 94. To each tender must be attached the usual signatures of two responsible and solvent persons, residents of the Dominion, willing to become sureties for the carrying out of the contract.

**Contract.**
**Suretie's indenture.**
**Time.** 95. The person or persons whose tender is accepted shall execute at once a contract under seal, similar in its provisions to the form of Indenture hereto annexed, and it will be assumed that parties tendering have made themselves perfectly familiar with its contents; and further, may contain such special provisions as the Minister of Public Works for the Dominion of Canada may determine, and the surety or sureties for the Contractor shall also execute at the same time an Indenture similar in its provisions to the form of Sureties' Indenture annexed to the said form of Contract, and containing such special provisions as the said Minister may determine.

96. The works are to be commenced and proceeded with as soon as practicable after the person or persons whose "Tender" may be accepted, shall have entered into the contract.

SANDFORD FLEMING,
*Engineer-in-Chief.*

Canadian Pacific Railway Office,
* Department of Public Works,
Ottawa, 30th November, 1878.

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* The foregoing is the General Specification and Form of Contract adopted in November, 1878. The Department of Public Works was then undivided. Since 1st October, 1879, when a division of the Department took place, the words "Railways and Canals" have been substituted for "Public Works," wherever they occur.

# APPENDIX No. 22.

LIST OF CONTRACTS AND SUMMARY OF PAYMENTS MADE ON ACCOUNT OF WORK DONE UP TO 31ST DECEMBER, 1879, AND APPROXIMATE ESTIMATE OF EXPENDITURE INVOLVED.

| No. of Contract. | Name of Contractor. | Amount Paid. | Probable Amount involved. |
|---|---|---|---|
| | | $ cts. | $ cts. |
| 1 | Sifton, Glass & Co. | 115,100 40 | 146,020 00 |
| 2 | Richard Fuller | 128,765 55 | 197,353 00 |
| 3 | F. J. Barnard | 41,900 00 | 413,217 00 |
| 4 | Oliver, Davidson & Co. | 217,025 82 | 268,050 00 |
| 5 | Joseph Whitehead | 208,168 00 | 208,168 00 |
| 5a | Joseph Whitehead | 141,800 00 | 161,124 97 |
| 6 | Guest & Co. | 280,558 76 | 280,558 76 |
| 7 | Ebbw Vale Steel, Iron and Coal Co. | 254,177 08 | 254,177 08 |
| 8 | Mersey Steel and Iron Co | 1,065,842 29 | 1,065,842 29 |
| 9 | West Cumberland Iron and Steel Co. | 305,581 88 | 305,581 88 |
| 10 | West Cumberland Iron and Steel Co | | |
| 11 | Naylor, Benzon & Co | 265,052 36 | 265,052 36 |
| 12 | Hon. A. B. Foster. | 41,000 00 | 41,000 00 |
| 13 | Sifton & Ward | 313,200 87 | 313,200 87 |
| | Purcell & Ryan | 18,778 64 | 18,778 64 |
| 14 | Sifton & Ward | 633,480 00 | .................... |
| | Joseph Whitehead (Completing Contract No. 14) | 91,730 00 | 110,000 00 |
| 15 | Joseph Whitehead | 1,821,210 00 | 2,525,000 00 |
| 16 | Canada Central Railway Co | 563,715 00 | 1,440,000 00 |
| 17 | Anderson, Anderson & Co | 51,462 96 | 51,462 96 |
| 18 | Red River Transportation Co | 213,928 24 | 218,550 00 |
| 19 | Moses Chevrette | 1,600 00 | 1,600 00 |
| 20 | Merchants' Lake and River Steamship Co. | 67,126 28 | 67,126 28 |
| 21 | Patrick Kenny | 8,782 11 | 8,782 11 |
| | Carried forward | 6,849,961 33 | .................... |

**Summary** of Payments made on account of Work done up to 31st December, 1879, &c.—Canadian Pacific Railway—*Continued.*

| No. of Contract. | Names of Contractors. | Amount paid. | Probable Amount involved. |
|---|---|---|---|
| | | $ cts. | $ cts. |
| | Brought forward | 6,849,981 33 | ........ |
| 22 | Holcomb & Stewart | 5,850 00 | 5,850 00 |
| 23 | Sifton & Ward | 14,648 14 | 14,648 14 |
| 24 | Oliver, Davidson & Co | 3,525 10 | 3,525 10 |
| 25 | Purcell & Ryan | 1,346,100 00 | 1,400,000 00 |
| 26 | James Isbester | 35,431 00 | 35,431 00 |
| 27 | Merchants' Lake and River Steamship Co. | 89,060 00 | 89,060 00 |
| 28 | Red River Transportation Co | ........ | ........ |
| 29 | Cooper, Fairman & Co | 8,532 90 | 8,532 90 |
| 30 | Robb & Co | 16,160 00 | 16,160 00 |
| 31 | Patent Bolt and Nut Co. | 6,800 69 | 6,800 69 |
| 32 | Cooper, Fairman & Co | 13,737 50 | 13,737 50 |
| 32a | LeMay & Blair | 17,730 45 | 17,730 45 |
| 33 | Kavanagh, Murphy & Upper | 91,500 00 | 202,652 50 |
| 34 | North-West Transportation Co | 110,400 44 | 110,400 44 |
| 35 | Cooper, Fairman & Co | 23,880 00 | 23,880 00 |
| 36 | William Robinson | 56,700 92 | 69,494 92 |
| 37 | Heney, Charlebois & Flood | 11,000 00 | ........ |
| 38 | Edmond Ingalls | 3,456 85 | 3,456 85 |
| 39 | John Irving | 9,660 00 | ........ |
| 40 | Gouin, Murphy & Upper | 24,600 00 | 33,785 00 |
| 41 | Purcell & Co | 445,300 00 | 2,300,196 00 |
| 42 | Manning, Macdonald, McLaren & Co. | 96,100 00 | 4,130,707 00 |
| 43 | Joseph Upper & Co | ........ | ........ |
| 44 | West Cumberland Iron and Steel Co. | 50,064 74 | 50,064 74 |
| 45 | Barrow Hœmatite Steel Co | 37,844 59 | 37,844 59 |
| 46 | Ebbw Vale Steel, Iron and Coal Co | 37,072 28 | 37,972 28 |
| 47 | Patent Bolt and Nut Co | 2,277 60 | 2,419 71 |
| 48 | John Ryan | 12,030 00 | 600,500 00 |
| | Carried forward | 9,420,344 53 | ........ |

**Summary** of Payments made on account of Work done up to 31st December, 1879, &c.—Canadian Pacific Railway—*Continued.*

| No. of Contract. | Names of Contractors. | Amount paid. | Probable Amount involved. |
|---|---|---|---|
| | | $ cts. | $ cts. |
| | Brought forward | 9,420,344 53 | |
| 49 | Richard Dickson | 13,050 00 | 16,066 20 |
| 50 | Miller Brothers & Mitchell | 35,425 00 | 35,425 00 |
| 51 | Dominion Bolt Co. | 2,662 50 | 2,662 50 |
| 52 | North-West Transportation Co. | 15,084 00 | 24,000 00 |
| 53 | Barrow Hœmatite Steel Co | | 882,500 00 |
| 54 | Guest & Co | | |
| 55 | West Cumberland Iron and Steel Co. | | |
| 56 | Kellogg Bridge Co | | 2,500 00 |
| 57 | Truro Patent Frog Co | | 12,000 00 |
| 58 | W. Hazlehurst | | 6,096 00 |
| 59 | Whitehead, Ruttan & Ryan | | 27,750 00 |
| 60 | Andrew Onderdonk | | 2,727,300 00 |
| 61 | Ryan, Goodwin & Co | | 2,573,640 00 |
| 62 | Andrew Onderdonk | | 2,056,950 00 |
| 63 | Andrew Onderdonk | | 1,746,150 00 |
| 64 | Ryan, Whitehead & Ruttan | | 7,350 00 |
| 65 | James Crossen | | 25,500 00 |
| 66 | Bowie & McNaughton | | 438,914 00 |
| 67 | Moncton Car Co | | 70,800 00 |
| | Under Contracts | 9,486,566 03 | |
| | **Expenditure not under Contract.** | | |
| | Explorations and surveys | 3,119,617 79 | |
| | Engineering, and supervision of construction | 993,094 00 | |
| | Fort Francis Lock | 289,028 51 | |
| | Red River Route | 22,995 27 | |
| | Miscellaneous payments | 376,522 41 | |
| | Total | $14,287,824 01 | |

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* Contracts No. 53, 54 and 55, embrace 45,000 tons of steel rails with fastenings, of which 11,000 tons will be used on the Rivière du Loup Section of the Intercolonial Railway, the value of which has been deducted.

cember, 1879,

| Probable Amount involved. |
|---|
| $ cts. |
| 16,066 20 |
| 35,425 00 |
| 2,662 50 |
| 24,000 00 |
| 882,500 00 |
| 2,500 00 |
| 12,000 00 |
| 6,096 00 |
| 27,750 00 |
| 2,727,300 00 |
| 2,573,640 00 |
| 2,056,950 00 |
| 1,746,150 00 |
| 7,350 00 |
| 25,500 00 |
| 438,914 00 |
| 70,800 00 |

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# APPENDIX No. 23.

ESTIMATE REFERRED TO IN PARLIAMENT, 15TH APRIL, 1880, BY THE HONORABLE THE MINISTER OF RAILWAYS AND CANALS.

*The Minister of Railways and Canals to the Engineer-in-Chief.*

DEPARTMENT OF RAILWAYS AND CANALS,
OTTAWA, 15th April, 1880.

DEAR SIR,—The Pacific Railway debate will begin this afternoon, and I must ask you to furnish me with an estimate of cost. In doing this, take the following data:—

The four contracts recently let in British Columbia, making full allowances for the reductions to be made and referred to in your report on these contracts.

The contract for the first 100 miles west of Red River, as it is being carried out with half ballasting, etc.

The accepted tender for the work on the second hundred miles section west of Red River, ($438,914.)

With regard to the location and character of the railway, I am aware that your own preference has been for a line with light, easy gradients. The Government recognizes the advantage of this feature between Lake Superior and Manitoba, but west of Red River we attach less importance to it than the rapid settlement of the country and the immediate accommodation of settlers.

The policy of the Government is to construct a cheap railway, following, or rather, in advance of settlement, with any workable gradients that can be had, incurring no expenditure beyond that absolutely necessary to effect the rapid colonization of the country.

In accordance with this policy, Mr. Marcus Smith has found a line on the second hundred mile section where, two years ago, he reported it impracticable under the old system of gradients, and he has stated to me that there will be no heavier hundred mile section than this one between Manitoba and the Rocky Mountains. I am, therefore, perfectly justified in calling upon you to take the accepted tender for the second hundred miles section as the basis for estimating cost up to the mountains.

You have recently shown me returns from Messrs. Caddy & Jennings, indicating large reductions effected on Sections 41 and 42. The rails for these sections have been secured at very low rates, and there are other circumstances which I need scarcely say will enable you to place the cost of opening the line from Selkirk to Lake Superior at much less than the sum named a year ago.

Yours faithfully,

CHARLES TUPPER.

SANDFORD FLEMING, Esq.,
Engineer-in-Chief,
Canadian Pacific Railway.

## *The Engineer-in-Chief to the Honorable the Minister of Railways and Canals.*

CANADIAN PACIFIC RAILWAY,
OFFICE OF THE ENGINEER-IN CHIEF,
OTTAWA, 15th April, 1880.

The Honorable
Sir CHARLES TUPPER, K.C.M.G.,
Minister of Railways and Canals.

SIR,—I have the honor to submit the following estimate of expenditure necessary to place the Canadian Pacific Railway in operation from Lake Superior to Port Moody.

I understand the policy of the Government, with respect to the railway, to be:—

1. To construct the section between Lake Superior and Red River with the limited gradients and curves set forth in my reports laid before Parliament, so as to secure cheap transportation, and to provide, by the time the railway shall be ready for opening, an equipment of rolling stock and general accomodation sufficient for the traffic to be then looked for.

2. To proceed with the work west of Red River by constructing 200 miles on the route recently established. The roadway and works to be of the character defined by the 48th contract and the tenders for the 66th contract recently received.

To proceed with the construction of 125 miles in British Columbia, under the 60th, 61st, 62nd, and 63rd contracts. The expenditure on the 125 miles to be limited in accordance with the provisions of the contract, and the views set forth in my report of the 22nd November last.[*]

To proceed gradually with the intervening distance. To delay placing additional sections under contract in British Columbia until the 125 miles are completed, or well advanced, thus preventing any undue increase in the price of labor.

To carry construction westward from Manitoba across the Prairie Region only as settlement advances.

In my report of last year, I placed the cost of the section between Lake Superior and Red River at $13,000,000. Since that date the steps taken to keep down the expenditure on the 185 miles between English River and Keewatin have been so far successful as to reduce the length about 3¾ miles, and the estimated cost fully $500,000. The rails for these two contracts have likewise been secured at a considerably lower price than the estimate. Whatever an increasing traffic in future years may demand in the way of terminal accommodation and rolling stock, I am confident the line can be opened for traffic between Fort William and Selkirk, well equipped for the business which may then be expected, at a cost not exceeding $17.000,000.

West of Red River, 100 miles have been placed under contract, and tenders have been received for a second 100 miles section. These two sections are designed to be constructed and equipped in the most economical manner, dispensing with all outlay except that necessary to render the railway immediately useful in the settlement of the country. It is intended that the line be partly ballasted, to render it available for colonization purposes, full ballasting being deferred until the traffic demands high speed. It is intended to provide sufficient rolling stock for immediate wants, postponing full equipment until the country becomes populated, and the business calls for its increase.

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[*] Report on the British Columbia Section, 22nd November, 1879.—Extracts—"The total sum of the lowest tenders for the four Sections, as above stated, is $9,167,040. It will be borne in mind that the character of the contracts to be entered into is materially different from ordinary contracts. This sum represents the maximum—the expenditure is not to exceed this amount, but it may be very much less (see clauses 5, 6 and 7.)

"Those who made the surveys and calculations inform me that the quantities are very full, and that in actual execution they can be largely reduced. I am convinced, moreover, that by making an extremely careful study of the final location, by sharpening the curvature in some places, by using great judgment in adjusting the alignment to the sinuosities and sudden and great irregularities of the ground, by substituting the cheaper classes of work for the more costly, wherever it can safely be done, and by doing no work whatever that is not absolutely necessary, a very marked reduction can be made."

On this basis and on the other data furnished, the railway may be opened from Lake Superior to the Pacific Coast within the following estimate:—

| | | | | |
|---|---|---|---|---|
| *Fort William to Selkirk* (406 miles) with light gradients, including a fair allowance of rolling stock and engineering during construction | | | | $17,000,000 |
| *Selkirk to Jaspar Valley* (1,000 miles) with light equipment, etc. | | | | 13,000,000 |
| *Jaspar Valley to Port Moody* (550 miles) with light equipment, etc.:— | | | | |
| Jaspar to Lake Kamloops, | 335 | at 43,660 | $15,500,000 | |
| Lake Kamloops to Yale, | 125 | " 80,000 | 10,000,000 | |
| Yale to Port Moody, | 90 | " 38,888 | 3,500,000 | |
| | | | $29,000,000 | |
| Add | | | 1,000,000 | 30,000,000 |
| Total miles, 1,956 | | | | $60,000,000 |

The above does not include cost of exploration and preliminary surveys throughout all parts of the country north of Lake Nipissing to James' Bay in the east, and from Esquimault to Port Simpson in the west, between Latitudes 49° and 56°, not properly chargeable to construction, $3,119,618, or the cost of the Pembina Branch, $1,750,000, or with other amounts with which the Pacific Railway account is charged.

I have the honor to be, Sir,

Your obedient servant,

SANDFORD FLEMING,

*Engineer-in-Chief.*

---

*The Engineer-in-Chief to the Honorable the Minister of Railways and Canals.*

CANADIAN PACIFIC RAILWAY,
OFFICE OF THE ENGINEER-IN-CHIEF,
OTTAWA, 16th April, 1880.

The Hon. Sir CHARLES TUPPER, K.C.M.G.,
Minister of Railways and Canals.

SIR,—In compliance with your directions, I have the honor to consider the cost of the eastern section of the Pacific Railway extending from Thunder Bay, Lake Superior, to the eastern terminus, Lake Nipissing.

In my report recently laid before Parliament, I have referred to the projected line between South-East Bay, Lake Nipissing, and Sault St. Mary. The explorations of this district have established that a location can be had north of Lake Nipissing, which would be common for 60 or 70 miles to the St. Mary's branch and the main trunk line to the North-West. As the St. Mary's branch will, in all probability, be constructed before the through line is undertaken, the length of the latter will be reduced by the length of the location common to the two lines. The eastern terminus will consequently be advanced some 60 or 70 miles to the west, beyond the theoretical starting-point at Lake Nipissing. The length of the eastern section therefore, may be assumed not to exceed 600 miles.

It is impossible to say what labor and materials may cost some years hence, when the period arrives for the eastern section to be undertaken. Taking the basis of present prices and present contracts, and adhering to the economic principles of construction set forth in the letters of yesterday, I feel warranted in stating that $20,000,000 may be considered a fair estimate of the cost of opening the line from Fort William to the Eastern Terminus.

In order that the estimates of the cost of the line from Fort William to the Pacific and from Fort William to the Eastern Terminus near Lake Nipissing, be clearly understood, I deem it proper to submit the following explanations:—

I have in previous reports laid before Parliament, advocated a location for the railway with generally light gradients and other favorable engineering features. The policy of the Government, as stated in your letter, likewise the change of line by the abandonment of the old location west of Red River, render it necessary on my part to modify the views I have previously held.

The estimates now submitted are based on the new conditions and the data to which you refer, viz: on contracts recently let for four sections in British Columbia, and the reduction to be made thereon; on the contract for the first 100 miles section west of Red River; on the accepted tender for the second 100 miles section west of Red River; and on the assurance made by the Engineer who conducted the surveys in the Prairie Region, that there will be no more costly one hundred miles section between Manitoba and the Rocky Mountains than the second 100 miles section west of Red River; that hence this section may be taken to be representative of the whole work to the base of the mountains. I have likewise estimated the amount of rolling stock as limited to the extent considered absolutely necessary for colonization purposes, and I have not overlooked the fact that the transportation of rails and other materials, after our own line from Lake Superior to Manitoba shall have been comleted, will be reduced to nominal charges to cover actual outlay, instead of the very high rates we have been compelled to pay by the railways in the United States.

It must be borne in mind that if the present defined policy with respect to the gradual progress of the work be modified, or if the extent of the work be different from that assumed, or if its general character be altered, the cost may be affected by the change. The same result may be looked for if a higher price has to be paid for materials, or for labor, and if through these or other causes the contractors failing to perform what they have undertaken, the work in consequence has to be relet at higher prices. Under these circumstances the cost of the whole line may be increased.

The cost may be enhanced, moreover, if the location of the line be placed in the hands of careless or inefficient men, who may fail to exercise the prudence and judgment called for, or who may neglect, through want of care or skill, to lay out the work with regard to economy. Or if the supervision of the contracts be lax, so as to admit of the possibility of work not absolutely required being executed, or of payment being made in excess of work performed, increase of cost will result. From first to last the strictest economy will have to be enforced, and rigid control exercised over the expenditure. The estimate submitted is based on the data set forth, and on that data the whole main line, from Port Moody, on the Pacific coast, to the Eastern Terminus, in the neighborhood of Lake Nipissing, may be constructed in the manner and under the circumstances referred to, for about $80,000,000. But to meet any of the possible contingencies to which I have referred, I beg leave to recommend that in considering the subject of capital required for the undertaking, a liberal percentage be added.

I have the honor to be, Sir,

Your obedient servant,

SANDFORD FLEMING,

*Engineer-in-Chief.*

This subject was first brought up by S. F. Fleming in 1879. per H. C. Cox.

# APPENDIX No. 24.

## CORRESPONDENCE ON THE SUBJECT OF A SUBMARINE TELEGRAPH BETWEEN THE WESTERN COAST OF CANADA, ON THE PACIFIC OCEAN, AND THE TELEGRAPH SYSTEM OF ASIA.

CANADIAN PACIFIC RAILWAY.
OFFICE OF THE ENGINEER-IN-CHIEF,
OTTAWA, 11th June, 1879.

F. N. GISBORNE, Esq.,
Supt. Telegraph and Signal Service,
Dominion of Canada.

MY DEAR SIR,—I am desirous of directing your attention to a project in connection with the Pacific Railway Telegraph, which appears to me of great national importance, which calls for careful consideration, and on which, I do not doubt, your great experience and ability can throw much light.

The Pacific terminus of the Canadian Pacific Railway will, in all probability, be finally determined this year, and the telegraph now erected from Lake Superior and carried almost to the base of the Rocky Mountains will then be extended to tidewater in British Columbia.

In my last report laid before Parliament, I submitted the importance of connecting Lake Superior with Ottawa, the seat of Government, by telegraph, and I have reason to believe that the Government favor the reasons I have expressed.

If these connections are made we shall have a complete overland telegraph from the Atlantic to the Pacific Coast. For the greater part of the distance the line will be wholly constructed by the Canadian Government, and there will be little difficulty on the part of the Government in securing from ocean to ocean complete control of the telegraph system.

It appears to me to follow that, as a question of Imperial importance, the British possessions to the west of the Pacific Ocean should be connected by submarine cable with the Canadian line. Great Britain would then be brought into direct communication with all her greatest colonies and dependencies without passing through foreign countries.

The telegraph system of Europe is now extended easterly through Russia to the eastern coast of Asia. A second line follows the route by the Red Sea to India, China and Japan, with a branch to Australia, and certainly some of these points could be connected with the Pacific shores of Canada, and thence with the great cities on both sides of the Atlantic much more directly than they now are. Moreover, a sub-marine telegraph from the western coast of Canada to Asia, in continuation of the Pacific Railway line while completely girdling the globe by an electric wire, would connect with the Australian and New Zealand Branch, and, without question would extend the most important advantages to the whole outer Empire of Great Britain.

I feel that I cannot err in asking the assistance of yourself in this matter. As the originator of the first Atlantic telegraph scheme and one to whom the world is largely indebted for telegraphic communication between Europe and America, there can be few equally qualified to give advice on the subject.

I beg now, therefore, to ask you to give your earnest attention to the scheme, and to request that you will be good enough to report to me at your earliest convenience as to the practibility of the undertaking, its possible cost and traffic, the different routes which the line may take, and the general advantages it may claim when established.

I am sure the judgment which you will exercise, with the experience and practical ability you possess, will place the project, in all its bearings, in such a light that it can be brought before the Government in a complete form.

Yours very truly,

SANDFORD FLEMING,

*Engineer-in-Chief.*

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TELEGRAPH AND SIGNAL SERVICE,
OTTAWA, 13th June, 1879.

SANDFORD FLEMING, Esq., C.M.G.,
Engineer-in-Chief, Canadian Pacific Railway.

DEAR SIR,—I fully appreciate the kind and complimentary manner in which you have requested me to report officially upon the feasibility, commercial value and importance of telegraph communication between Europe, America and Asia, *viâ* the Dominion of Canada.

As already explained, it is a subject to which I have given much consideration for some years past, and, with yourself, I am of opinion that the time has now arrived when public attention should be directed to an enterprise of so much moment to Imperial and Colonial interests.

It is evident that the Government, which possesses the exclusive privilege of controlling the Canadian Pacific Railway route for telegraphic purposes, must occupy a position of great national importance, inasmuch as they will not only hold the shortest, most feasible, and therefore the most economical line of communication between the commercial emporiums of North and South America and the Empires of China and Japan, but also that such route will be equally available and preferable for telegraphic intercourse between Great Britain, those Empires and her Australian, New Zealand, and other eastern possessions, the present routes, *via* the Red Sea or Persia, entailing the repetition of despatches through various nationalities and in different languages.

The route advocated is, by land line, from Halifax, Nova Scotia, *via* Ottawa and Manitoba, to the Pacific terminus of the Canadian Pacific railway system, and thence by submarine cables, from the north-west point of Vancouver Island, to Yesso, Japan, where it would connect with lines now running to Hong-Kong, China, Australia, New Zealand and elsewhere.

First, as to the feasibility of the project, admitting without unnecessary argument the extraordinary advantages of the proposed land route along the line of Canadian Railways, not merely for construction, but also for maintenance and speedy repairs, *time* rather than *cost* being the essence of telegraphic success, you will notice upon referring to an Admiralty chart of the North Pacific Ocean, that the soundings between British Columbia and Japan are of an exceedingly uniform character, varying from 1,000 fathoms inshore to 3,000 fathoms in mid ocean, the bottom being invariably overlaid with black sand, clay and the ooze of defunct infusoria peculiar to those latitudes; also that in comparison with the deep portion of the bed of the Atlantic between Ireland and Newfoundland, the maximum difference in depth is under 300 fathoms.

Again, the distance between France and St. Pierre, following the route taken by the first French Cable Company, is 2,327 miles plus 706 miles between St. Pierre and Massachusetts, the length of the direct cable between Ireland, Nova Scotia, and the United States being some 200 miles longer; whereas the distance between British Columbia and Japan is about 3,300 miles, with a mid-station, if necessary, upon one of the Aleutian Islands, which would thus sub-divide the cable into two nearly equal lengths of about 1,650 miles each.

With the improved electric cables and signalling apparatus of the present day, it has already been demonstrated that communications can now be as readily and speedily transmitted through 3,000 miles of cable as was formerly practicable through a 2,000 mile conductor. Neither will the route indicated be liable to serious competition, for between the parallels of 30° north and 30° south of the equator the vast number of volcanic islands and coral reefs entirely precludes the successful accomplishment of cable enterprises within those limits. It was for such reason that the projected line in two sections of 2,000 and 3,000 miles in length between San Francisco and Japan, *vià* the Sandwich Islands, was abandoned, and I may also observe that a departure from British Columbia will insure a line 500 miles shorter than by any route starting west from San Francisco.

It is not anticipated that there will be any difficulty in obtaining landing rights from the United States Government upon one of the Aleutian Islands, if deemed advisable to divide the distance. The Japanese Government, on the other hand, I have reason to believe, will be most desirous to co-operate with and assist an enterprise of so much consequence to their Empire.

Secondly, as to the commercial value and importance of the undertaking.

It is extremely difficult to furnish any reliable data upon which to estimate the future amount of business which must pass over the line now contemplated, for all cable companies are reticent relative to sectional or special sources of revenue; but, taking the present tariff rates for messages *vià* Europe, at $3 75 per word, considerably less than half that rate would yield a handsome profit on the route *vià* Canada and the Pacific.

Again, from London or Paris to Japan, *vià* the Red Sea route, the present charge is $3 per word, while little more than two-thirds of such rate would yield an equally profitable return between the same points *vià* Canada.

It is not unreasonable to suppose, therefore, that the great and fast increasing telegraph business, not only between all America, but also between Great Britain and other European countries and the far east, would, in great measure, be diverted to the new route.

I may here note that the Pacific cable might be laid direct to one of the smaller islands north of Yezo, which island could probably be acquired or purchased from the Japanese Government, and thence laid to Hong-Kong, whence by an alternative route it might be continued direct to Australia, thus securing a through line of communication, which, whenever required, could be placed under the immediate control of the Imperial Government.

The cost of the Pacific cable to Japan, including the completion of the Canadian land lines, I estimate at £800,000 sterling ($4,000,000), and business equal to one-half the capacity of the first French cable between Brest and Massachusetts (the relative cable distances being very nearly the same), would render it a paying investment.

I have, therefore, no hesitation in expressing a decided opinion as to the complete practicability of the enterprise herein referred to, and from the consideration which I have given to the question of cost and traffic, I feel assured that the undertaking, as a whole, would be as successful and remunerative as it is important to the general interests of Great Britain and her dependencies.

I am, dear Sir,
Your most obedient servant,
F. N. GISBORNE, *Govt. Supt.*,
*Telegraph and Signal Service.*

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